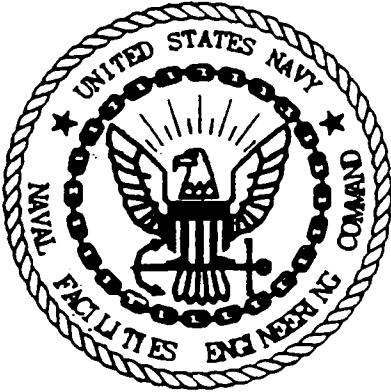


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VERIFICATION INVESTIGATION WORK PLAN NAVEODTEHCEN STUMP NECK ANNEX  
NSWC INDIAN HEAD MD  
9/15/1995  
ENSAFE/ ALLEN AND HOSHALL

# **VERIFICATION INVESTIGATION WORK PLAN**

**NAVEODTEHCEN — STUMP NECK ANNEX  
INDIAN HEAD, MARYLAND  
CTO-004**



**Prepared for:**

**Naval Explosive Ordnance  
Disposal Technology Center  
Indian Head, Maryland  
Stump Neck Annex**

**Submitted to:**

**CHESDIVNAVAFACENGCOM**

**CONTRACT NUMBER: N62467-89-D-0318**



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Appendix B	USATHAMA Methods

## ABBREVIATIONS AND ACRONYMS

CAR	Contamination Assessment Report
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-Term Environmental Action Navy
CLP	Contract Laboratory Program
DQO	Data Quality Objective
E/A&H	EnSafe/Allen & Hoshall
EFD	Engineering Field Division
EIC	Engineer-in-Charge
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
FSP	Field Sampling Plan
HASP	Health and Safety Plan
HMX	Cyclotetranethylenetetranitromine
HSWA	Hazardous and Solid Waste Amendments
IDW	Investigation-Derived Waste
IR	Installation Restoration
LQAC	Laboratory Quality Assurance Coordinator
MDE	Maryland Department of Environment
mg/m <sup>3</sup>	milligrams per cubic meter
msl	mean sea level
NAVEODTEHCEN	Navy Explosive Ordnance Disposal Technical Center
NBS	National Bureau of Standards
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFESC	Naval Facilities Engineering Service Center (formerly NEESA)
NOS	Naval Ordnance Station
NTU	Nephelometric Turbidity Units
OB/OD	Open burning/open detonation
OSHA	Occupational Safety and Health Administration
PE	Performance Evaluation
PID	Photoionization Detector
PPE	Personal Protective Equipment
PVC	Polyvinyl chloride
QA/QC	Quality assurance/quality control
QAO	Quality Assurance Officer
RCRA	Resource Conservation and Recovery Act
RDX	Cyclotrimethylenetrinitramine
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
SCBA	Self-contained breathing apparatus
SHSO	Site Health and Safety Officer
SOP	Standard operating procedure
SOP/QAM	Standard Operating Procedures/Quality Assurance Manual
SVOC	Semivolatile organic compounds



SWDA	Solid Waste Disposal Act
SWMU	Solid Waste Management Unit
TNT	Trinitrotoluene
USATHMA	U.S. Army Toxic and Hazardous Materials Agency
USC	U.S. Code
USGS	U.S. Geological Survey
VI	Verification Investigation
VOC	Volatile organic compound
VSI	Visual Site Inspection
$\mu\text{g}/\text{m}^3$	micrograms per cubic meter

## 1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) issued permit No. MD 417-009-0001 to the U.S. Navy for the Naval Explosive Ordnance Disposal Technology Center (NAVEODTECHCEN) at Stump Neck Annex, Indian Head, Maryland, for corrective action and waste minimization under the following authorities:

- The Solid Waste Disposal Act (SWDA) as amended by the Resource Conservation and Recovery Act (RCRA) of 1976 and as amended by the Hazardous and Solid Waste Amendments (HSWA) of 1984, 42 U.S. Code (USC) 6901 et seq.
- EPA regulations at Title 40 Code of Federal Regulations (CFR) Parts 260-271 and Part 124.

The NAVEODTECHCEN permit is effective from January 24, 1991, to January 23, 2001.

The complete RCRA permit for the purposes of Section 3005(c) of RCRA 42 USC 6925(c) consists of two portions: the EPA-issued permit described above and a permit issued by the Maryland Department of Environment (MDE) on April 15, 1988. The state permit was issued in accordance with Provision of the Code of Maryland Regulations, Title 26, Subtitle 13. The state was granted this authority under Section 3006(b) of RCRA, 42 USC 6926(b), for enforcement in lieu of federal hazardous waste management program under RCRA.

Pursuant to this permit, the EPA has ordered that a Verification Investigation (VI) be conducted at several sites of the NAVEODTECHCEN's Stump Neck Annex Site. The objectives of this investigation are: (1) to investigate releases or suspected releases of hazardous waste and/or hazardous constituents into soil and/or groundwater to determine whether corrective measures are necessary to protect human health and the environment and/or whether to implement Interim

Measures and; (2) to screen from further investigation those solid waste management units (SWMUs) which do not threaten human health or the environment.

This document includes a VI Work Plan for the Rum Point Landfill; Chicamuxen Creek's Edge Dump Site B; and the Air Blast Pond, all of which are at the Stump Neck Annex. The investigations, designed to meet the above objectives, are submitted in accordance with the provisions of the Department of Navy Contract N6267-89-D-0318/0004. They will be conducted in accordance with the VI work plan submitted to the EPA Region III, and the MDE.

## **2.0 SITE BACKGROUND INFORMATION**

The following sections discuss the physiographic setting of the Stump Neck Annex. Location, topography, geology, and hydrogeology are described below.

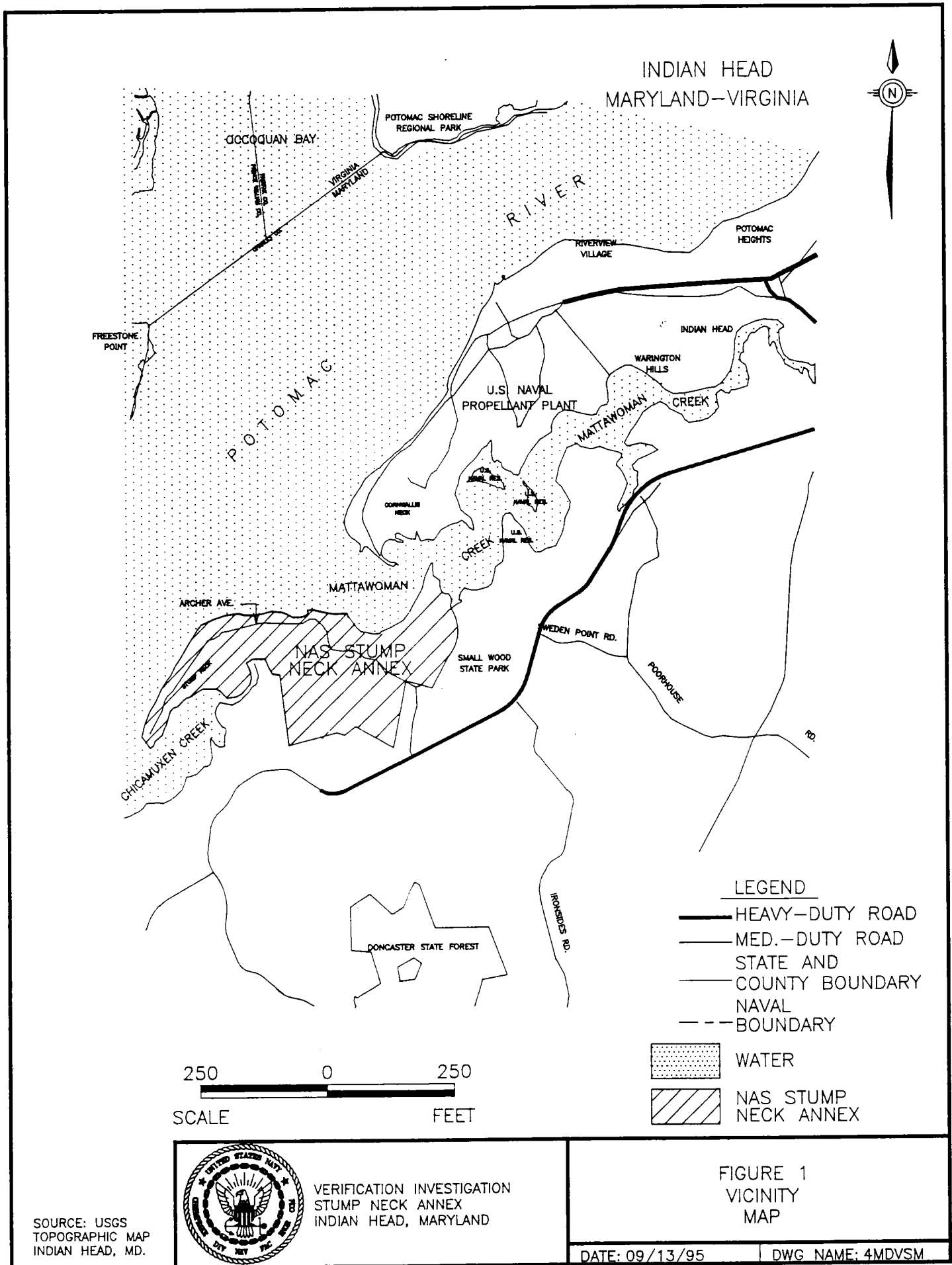
### **2.1 Location and Description**

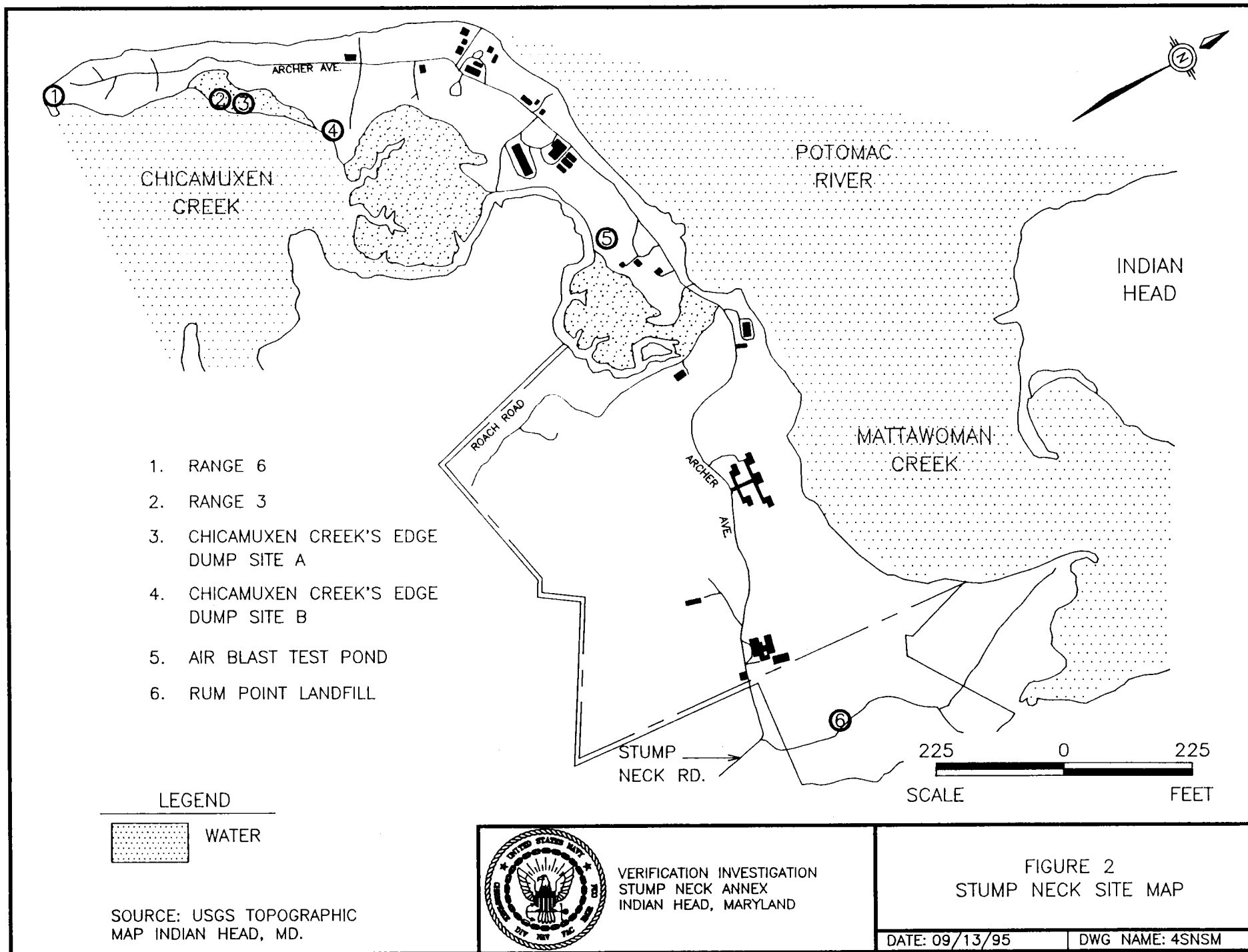
The Naval Ordnance Station (NOS) is at Indian Head, Maryland, encompassing approximately 3,500 acres divided between two peninsulas along the eastern shore of the Potomac River (Figure 1). The larger peninsula is designated as the Naval Ordnance Station-Indian Head (NAVORDSTA); the smaller peninsula (about 1,100 acres) is designated as Naval Ordnance Station, Stump Neck Annex (Stump Neck) (Figure 2). Operations at NAVORDSTA are conducted under the NAVORDSTA command, while operations at Stump Neck, the subject of this permit application, are conducted as tenant command of NAVORDSTA, the NAVEODTEHCEN. The NAVEODTEHCEN is noncontiguous from the main NAVORDSTA reservation by Mattawoman Creek.

As a NAVORDSTA tenant command, NAVEODTEHCEN's mission is to research, develop, test, and evaluate technical matters concerning explosive ordnance disposal (EOD). The facility's mission includes developing procedures to render conventional and special weapons, including guided missiles and biological and chemical munitions, and to develop tools, equipment, and techniques for both U.S. and foreign weapons.

### **2.2 Topography**

The Stump Neck peninsula has a flat to slightly rolling topography. Most of the land adjacent to Chicamuxen and Mattawoman are wetlands with slopes of 3% or less. The inland portion of the peninsula has slopes of 5% or more in many places.





Elevations at Stump Neck range from mean sea level (msl) to 143 feet. Elevations along the creeks' boundaries are 30 feet or less. There are, however, a few 50- to 60-foot bluffs along the Mattawoman Creek between Stump Neck and Rum Point (RFA, 1989).

### **2.3 Geology**

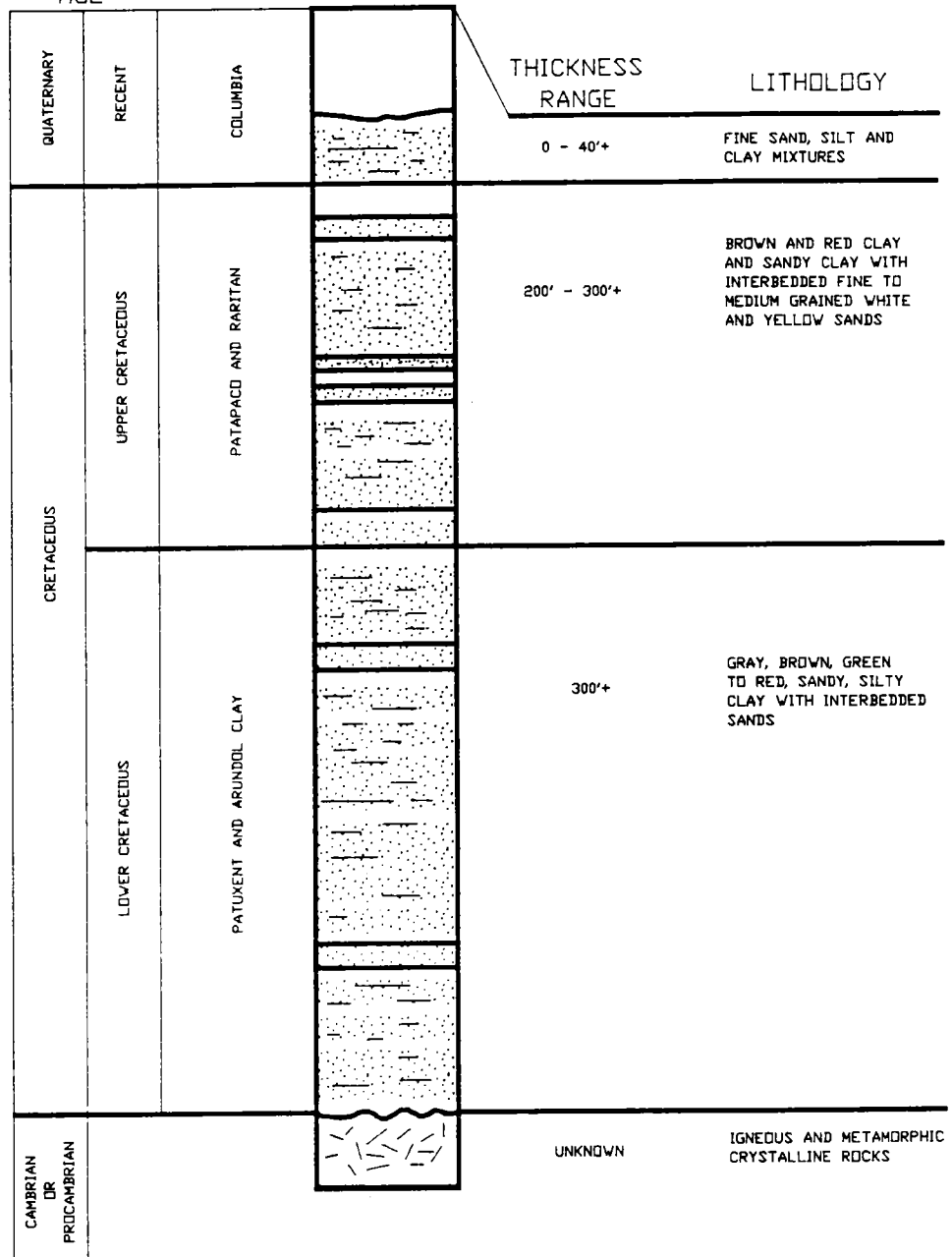
The geology at NOS Indian Head consists of 600 to 700 feet of unconsolidated fluvial and marine deposits unconformably overlying dense, hard, crystalline metamorphic and igneous basement rock. The deposits are mainly Cretaceous, Tertiary, and Quaternary age, while the bedrock is Precambrian or Cambrian age. The geologic time scale shown in Table 2-1 puts these ages in perspective.

The major stratigraphic units in this area are the Patuxent and Arundel Clay Formations of Lower Cretaceous age, the Patapsco and Raritan Formations of Upper Cretaceous age, and the Columbia Formation of Quaternary age. These units outcrop beneath the Potomac River or to the west of the river in Virginia. The formations strike to the northeast and dip to the southeast at 25 feet per mile. Figure 3 depicts the general lithologic column in the Indian Head area and Figure 4 is a cross section of the subsurface geology from the Virginia outcrop, through the Indian Head area, and into Charles County.

Stump Neck's geology is similar to the geology of the Indian Head peninsula except its easternmost boundary borders the subcrop of the Aquia Greensand. The Aquia Greensand in this area ranges from 0 to 20 feet thick.

The physical properties of the main formations in the Indian Head and Charles County area are described in Sections 2.3.1 through 2.3.4.

GEOLOGIC  
AGE UNIT



SOURCE: AWARE, INC. (1982)



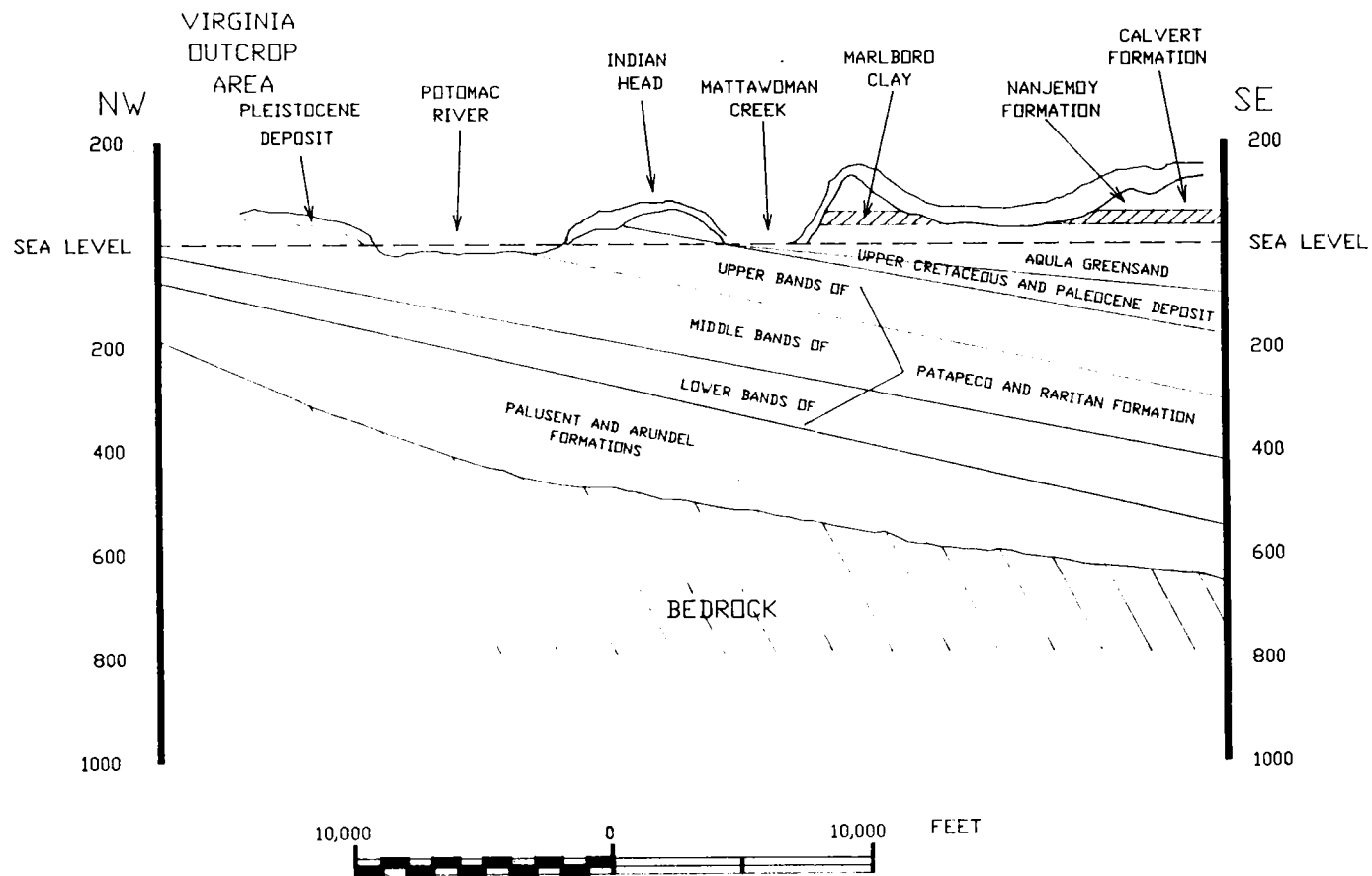
VERIFICATION INVESTIGATION  
STUMP NECK ANNEX  
INDIAN HEAD, MARYLAND

FIGURE 3  
LITHOLOGIC COLUMN

DATE: 08/17/95

DWG NAME: 4LCM





SOURCE: AWARE, INC. (1982)



VERIFICATION INVESTIGATION  
STUMP NECK ANNEX  
INDIAN HEAD, MARYLAND

FIGURE 4  
CROSS SECTION OF STUMP  
NECK VICINITY

DATE: 08/17/95

DWG NAME: 4CCVM

Table 2-1  
 Geologic Time Scale

ERA	Period	EPOCH	Age Range
Cenozoic	Quaternary	Holocene (Recent)	0-11,000 years
		Pleistocene	11,000-2 million years
	Tertiary	Pliocene	2-5 million years
		Miocene	5-25
		Oligocene	25-35
		Eocene	35-55
		Paleocene	55-65
Mesozoic	Cretaceous	Upper	65-90
		Lower	90-140
	Jurassic		140-190
	Triassic		190-230
Paleozoic	Permian		230-280
	Pennsylvanian		280-320
	Mississippian		320-350
	Devonian		350-400
	Silurian		400-430
	Ordovician		430-500
	Cambrian		500-600
Precambrian	Proterozoic		600+
	Archeozoic		from 4,600?

Source:

Sowers (1979)

### **2.3.1 Columbia Formation**

The Quaternary age Columbia Formation consists of Pleistocene and recent deposits. In Charles County it ranges from 0 to greater than 60 feet thick but does not exceed 40 feet in thickness at Indian Head (AWARE, Inc., 1982). These tan and orange deposits consist of irregularly bedded mixtures of fine sand, silt, and clay. The deposits are subdivided into; the lowland deposits, which range from 0 to 40 feet msl, and the upland deposits at elevations greater than 40 feet msl. The upland deposits usually contain coarser-grained materials, including gravel and cobble beds.

### **2.3.2 Aquia Greensand**

The Aquia Greensand of Tertiary age consists of light to dark olive glauconitic sand interbedded with very fine sand, silt, and clay. The sands are salt and pepper in appearance. The Aquia Greensand averages between 80 to 150 feet thick in Charles County but is usually less than 20 feet thick in the easternmost portion of Stump Neck.

### **2.3.3 Patapsco and Raritan Formation**

In Charles County the Upper Cretaceous age Patapsco and Raritan Formations are usually grouped as one hydrogeologic unit because of the difficulty in separating them based on lithology. The formation consists mostly of brown and red clay and sandy clay interbedded with yellow and white fine- to medium-grained sand. Most of the clay is tough and wax-like. Formation thickness ranges from 200 feet in the western part of the county to 700 feet in the central part. The sands cannot be traced laterally for more than a few miles in this area. However, well logs for the county indicate a regular sequence of position and thickness of the sands. Thus, the sands of the Patapsco and Raritan Formations are divided into the lower, middle, and upper sand units based on hydrology. This formation dips roughly 25 feet per mile to the southeast.

#### **2.3.4 Patuxent and Arundel Clay Formations**

The Patuxent and Arundel Clay Formations are of Lower Cretaceous age. In the Washington, D.C., and the Baltimore areas a distinction can be made between the Patuxent and Arundel Clay Formations, but not in the central and southern portions of the Southern Maryland geographic region. The entire sequence is considered the Patuxent Formation, which consists of sandy silty clays, interbedded with sand zones that often contain gravel. In the Indian Head area, the formation consists of approximately 77% clay and related fine sediment. The rest is sand and coarser material. The color of the clay varies from gray, brown, light green, and deep red. The top of the Patuxent has been arbitrarily placed at the bottom of the lowest sand unit of the Patapsco and Raritan Formations. The Patuxent overlies crystalline bedrock with an irregular erosional surface. The formation is around 300 feet thick in the Indian Head area. The top of the unit lies approximately 250 to 300 feet below msl. The Patuxent dips 30 to 50 feet per mile.

#### **2.4 Hydrology**

Available data indicate that the near-surface groundwater aquifer at Stump Neck Annex is hydrologically connected to the adjacent surface water systems; flow appears mostly lateral in nature. The area is part of the Potomac River estuary, which is subject to tidal, diurnal, and seasonal influences which fluctuate the quality and position of the groundwater.

A USGS Water-Resources Investigation Report discusses the multiple aquifers in the Patapsco and Patuxent Formations as the Potomac Group aquifer system. Transmissivities of the Potomac Group range from 3,000 to 6,000 (gal/d)/ft and storage coefficients range from 0.0002 to about 0.004 (Slaughter and Otton, 1968, p. 49). The Patapsco Formation in the Indian Head area contain two or more relatively continuous water bearing sand horizons separated by tight clay lenses functioning as local confining units. The Patapsco formation is exposed along the shore and bluffs on the Maryland side of the Potomac River, but is confined by the overlying Tertiary sediments immediately to the east (Aquia Greensand). Groundwater in the outcrop of the Patapsco Formation is under water-table or semiconfined conditions and is probably

hydraulically connected to the shallow flow system comprised of overlying surficial gravel deposits. Groundwater in the middle and lower parts of the Patapsco aquifer is confined in this area and is probably hydraulically connected to the Potomac River where they crop out under the permeable complex of Quaternary deposits beneath the Potomac estuary (Hiortdahl, 1991).

The Arundel Formation consists of tough clay and silt, and is frequently referred to as the Arundel Clay. It functions hydrologically as a confining unit and, where present, it effectively separates the underlying Patuxent aquifers from the overlying Patapsco aquifers.

## **2.5 Soil**

The facility is on three different soil associations: the Evesboro-Keyport-Elkton Association of the peninsula on the western part of the facility, the Bibb-Tidal Marsh-Swamp Association in the central portion of the facility, and the Beltsville-Exum-Wickham Association in the eastern portion except for the northeastern section near Rum Point, which is Evesboro-Keyport-Elkton Association (Figure 5 [RFA, 1989]). Soils in the area are typically silty loams exhibiting a relatively low permeability, and tidal marsh. Records indicate (IAS 1983; RFA 1989) that Chicamuxen Creek's Edge Dump Site B/Range 3 Burn Point, have been significantly altered by fill.

### **2.5.1 Beltsville-Exum-Wickham Association**

Beltsville-Exum-Wickham Association Soil is typically moderately sloping and on elevated areas moderately dissected by major rivers and streams. Beltsville soil is highly erodible on moderate slopes. It is very silty with dense fragiapsans that retard the downward movement of water. The soil near the Rum Point Landfill is a Beltsville silt loam with 5% to 10% slopes (RFA, 1989).

### **2.5.2 Evesboro-Keyport-Elkton Association**

Evesboro-Keyport-Elkton Association soil is level to moderately sloping soil ranging from sandy, excessively drained soil to loamy, poorly drained soil, with underlying clayey subsoil. Elkton

MAP NO.	SYMBOL	SOIL SERIES NAME
1	Cu	CUT-AND-FILL LAND
2	Bo	BIBB SILT LOAM
3	GvE	GRAVELLY LAND; STEEP
4	Au	AURA GRAVELLY SANDY LOAM
5	Bl	BELTSVILLE SILT LOAM
7	Kp	KEYPORT SILT LOAM
9	Ek	ELKTON SILT LOAM
10	Tm	TIDAL MARSH
11	Ms	MATAWAN LOAMY SAND
15	Sh	SASSIFIAS SANDY LOAM
17	Ga	GALESTORUN LOAMY SAND
18	Ot	OTBELTO SILTY LOAM
19	Wo	WOODSTOWN SANDY LOAM
20	Ex	EXUM SILT LOAM
21	Mn	MATAPEAKE SILT LOAM
22	Mu	MATTAPEX SILT LOAM



SOURCE: INITIAL ASSESSMENT STUDY, NAVAL  
ORDNANCE STATION, INDIAN HEAD, MD.



VERIFICATION INVESTIGATION  
STUMP NECK ANNEX  
INDIAN HEAD, MARYLAND

FIGURE 5  
NECK ANNEX  
SOIL MAP OF STUMP

DATE: 08/16/95

DWG NAME: 4SMP

soil is nearly level, poorly drained soil with clay or silty clay subsoil while Keyport soil is moderately well-drained with clay or silty clay subsoil. Chicamuxen Creek's Edge Dump Site B is Keyport silt loams, with 2% to 5% slopes that are moderately eroded (RFA, 1989). The Air Blast Pond is in an area dominated by level Elkton silt loam and Keyport silt loam with 2% to 5% slopes that are moderately eroded.

### **2.5.3 Bibb-Tidal Marsh-Swamp Association**

Bibb-Tidal Marsh-Swamp Association soil is miscellaneous unclassified wetlands and poorly drained soil on flood plains. This soil association is in areas along major flood plains. Tidal Marsh soil is wet and unstable and subject to flooding by brackish or saline water. Chicamuxen Creek's Edge Dump Site B is bounded by Tidal Marsh soil.

## **2.6 Climate**

NAVEODTECHCEN experiences a continental type of climate with well-defined seasons, but the Chesapeake Bay and Potomac River have a moderating effect on the temperature. The climate is typical of the temperate belt in the Eastern U.S.: warm summers and wet cold winters. The average summer high is 89°F and the average winter low is 21°F.

Precipitation is rather evenly distributed throughout the year. Mean annual precipitation for Charles County is 47 inches. The mean annual frozen precipitation is 19 inches. Wind speeds for this area average 9 miles per hour. Prevailing winds are from the northwest, but become more southerly in the summer.

### **3.0 SOLID WASTE MANAGEMENT UNITS**

The EPA has designated three areas at the Stump Neck Annex for investigation: the Rum Point Landfill, Chicamuxen Creek's Edge Dump Site B, and the Air Blast Pond. Figure 2 shows the site locations.

#### **3.1 Rum Point Landfill (SWMU 1)**

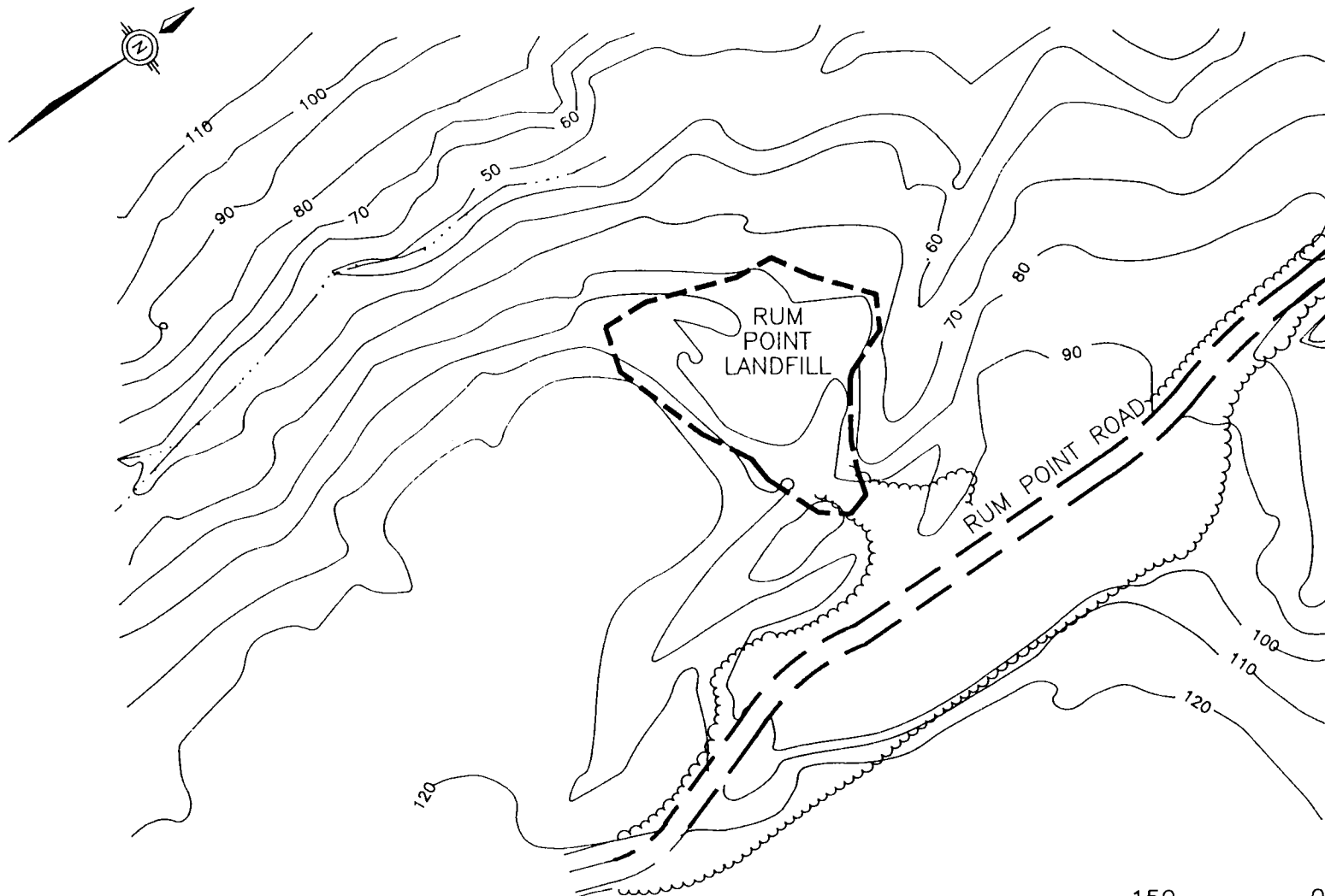
The unit is an unlined landfill west of Rum Point Road, of approximately 1.5 to 2.0 acres (Figure 6). It has been inactive since December 1989 and, according to facility representatives, was used for biodegradable waste disposal. A site inspection conducted in 1983 identified metal parts including garbage cans, 55-gallon drums, a hot water heater, a metal chair, a rusted land mine, and a partially exposed projectile. In addition, ash from the Thermal Treatment Tank (SWMU 16) was disposed of at this facility on a one time basis (Frauenfelder, 1983). The ash composition at the time of the disposal was reportedly not documented. The most recent ash analysis was conducted in 1993, however, these results are not indicative of the ash disposed in the landfill since the materials treated in SWMU 16 have changed.

The unit is a large, flat, packed dirt area. The northwestern edge of the landfill drops 20 to 30 feet into a wooded area adjacent to an unnamed creek which flows south to north. An eroding, sparsely wooded embankment rises approximately 15 feet above the top of the landfill in its southern section.

#### **3.2 Chicamuxen Creek's Edge Dump Site B (SWMU 4)**

This unit is reported (RFA, 1989) to be an unlined, grass covered earthen area (Figure 7) adjacent to Chicamuxen Creek and in the immediate vicinity of the Old Demolition Range (SWMU 23). A small stand of trees separates the area from the water's edge. The RCRA Facility Assessment (RFA) states that records indicate the unit was used as a dump site. Facility representatives were unable to provide information on the exact location or the nature of any materials disposed.





# LEGEND

- UNPAVED ROAD
- 10' CONTOUR
- ~~~~~ WOODED AREA
- . - . - STREAM

SOURCE: USN BUREAU OF YARDS AND DOCKS  
AREA PUBLIC WORKS OFFICE, CHESAPEAKE  
WASHINGTON, D.C. DWG. 1029307



VERIFICATION INVESTIGATION  
STUMP NECK ANNEX  
INDIAN HEAD, MARYLAND

150 0 150  
SCALE FEET

FIGURE 6  
RUM POINT LANDFILL

DATE: 09/13/95

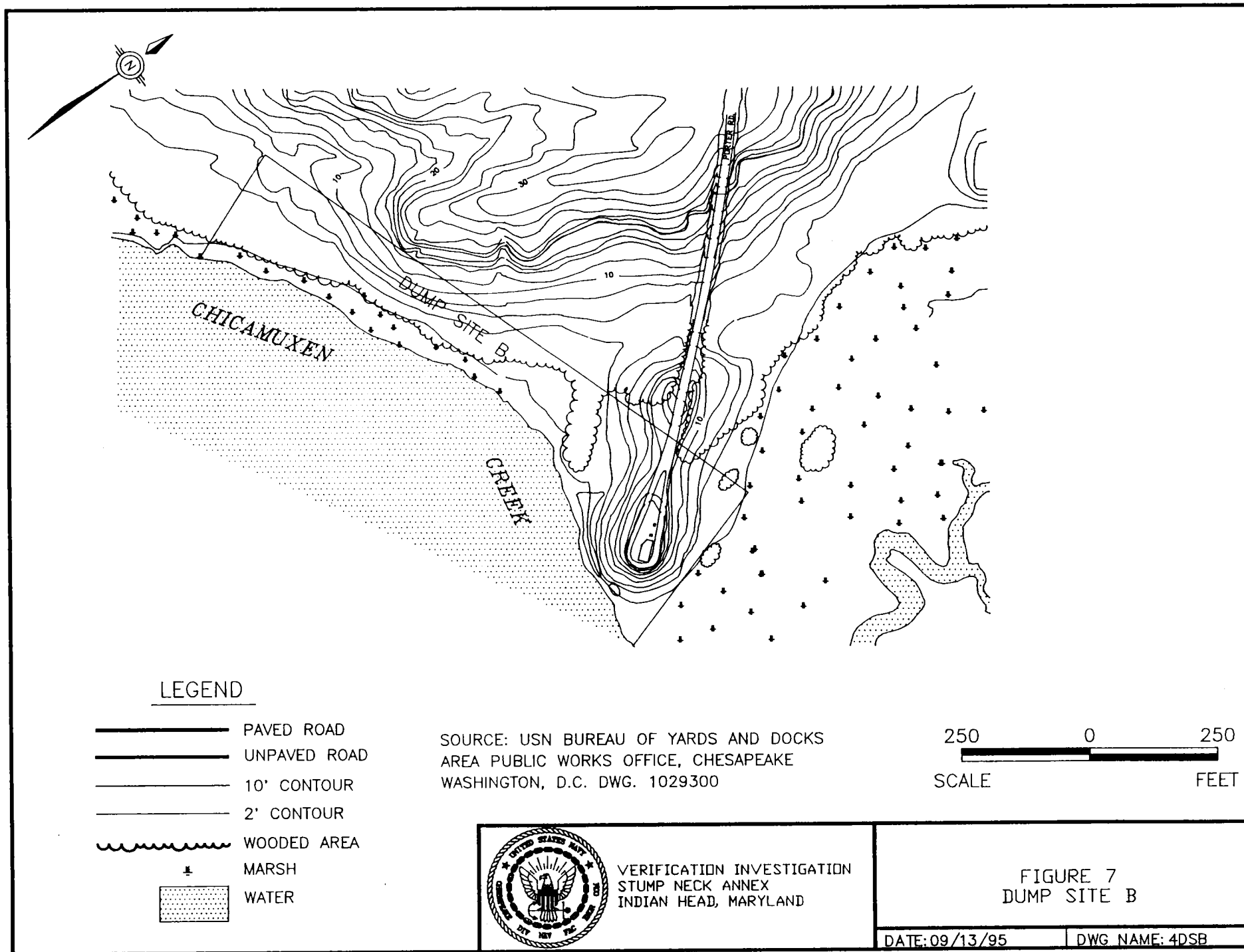
DWG NAME: 4RPLSM

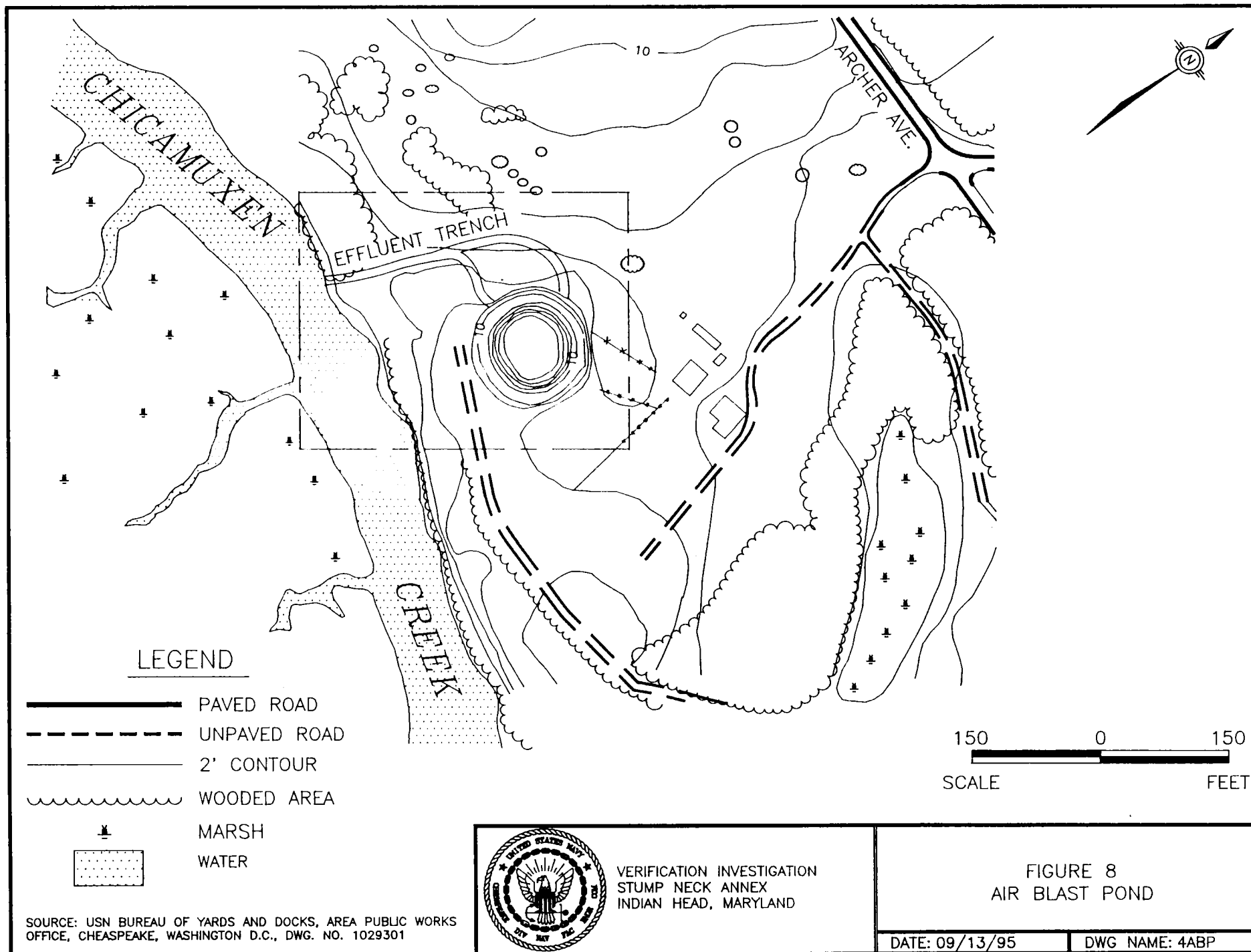
### **3.3 Air Blast Pond**

This unit (Figure 8), which has been inactive for 15 to 20 years (Field notes, 1988); was an explosive testing area consisting of a 100 foot-diameter earthen pit. Explosives were detonated over water in the pit to measure the concussion factor. The water was periodically discharged into Chicamuxen Creek through industrial outfall IW 32 (IAS, 1983).

The pond is in a wooded area of the facility overgrown with grass, briars, and small trees: approximately 25 steel pipes stand upright on the floor of the pond. In the wooded areas directly surrounding the unit, rusted and corroded drums were observed on leaf-covered soil. During the Visual Site Inspection (VSI), steel cylinders were on the bare soil in the wooded area. Two drainage ditches discharge into an adjacent creek, which appears to flow into Chicamuxen Creek.

According to the fact sheet for the HWMF permit (1990), explosives tested at this site included pentolite, HBX1, HBX2, H6, and C4 propellant.





#### **4.0 FIELD SAMPLING PLAN**

The following is a detailed Field Sampling Plan (FSP) for investigating possible chemical contamination of soil and groundwater at Stump Neck Annex. This section describes sampling and analysis for each VI site: the Rum Point Landfill, the Air Blast Pond, Chicamuxen Creek's Edge Dump Site B.

The sampling objective is twofold: first, to investigate releases or suspected releases of hazardous waste and/or hazardous constituents into soil and/or groundwater to determine whether corrective measures are necessary to protect human health and environment, and second, to screen from further investigation those SWMUs which do not threaten human health or the environment.

The FSP discusses specific sampling locations. The field investigation includes the advancing of soil borings, installing monitoring wells, hand augering for shallow soil samples, and magnetometer surveys. Soil samples will be collected from all soil borings. Once the aquifer has equilibrated following well installation and development, groundwater samples will be collected to assess if contamination is present.

The FSP outlines techniques to collect samples for chemical and physical analyses. This plan will be implemented to meet the following objectives:

1. Assess the areal extent and the nature, if any, of contamination from the previously identified sites.
2. Confirm, validate, and/or refute previous studies conducted at the facility and verify the hazardous substances of concern.
3. Collect specific data on the soil and the hydrogeology of the property to determine the mobility and impacts of the substances, if any.

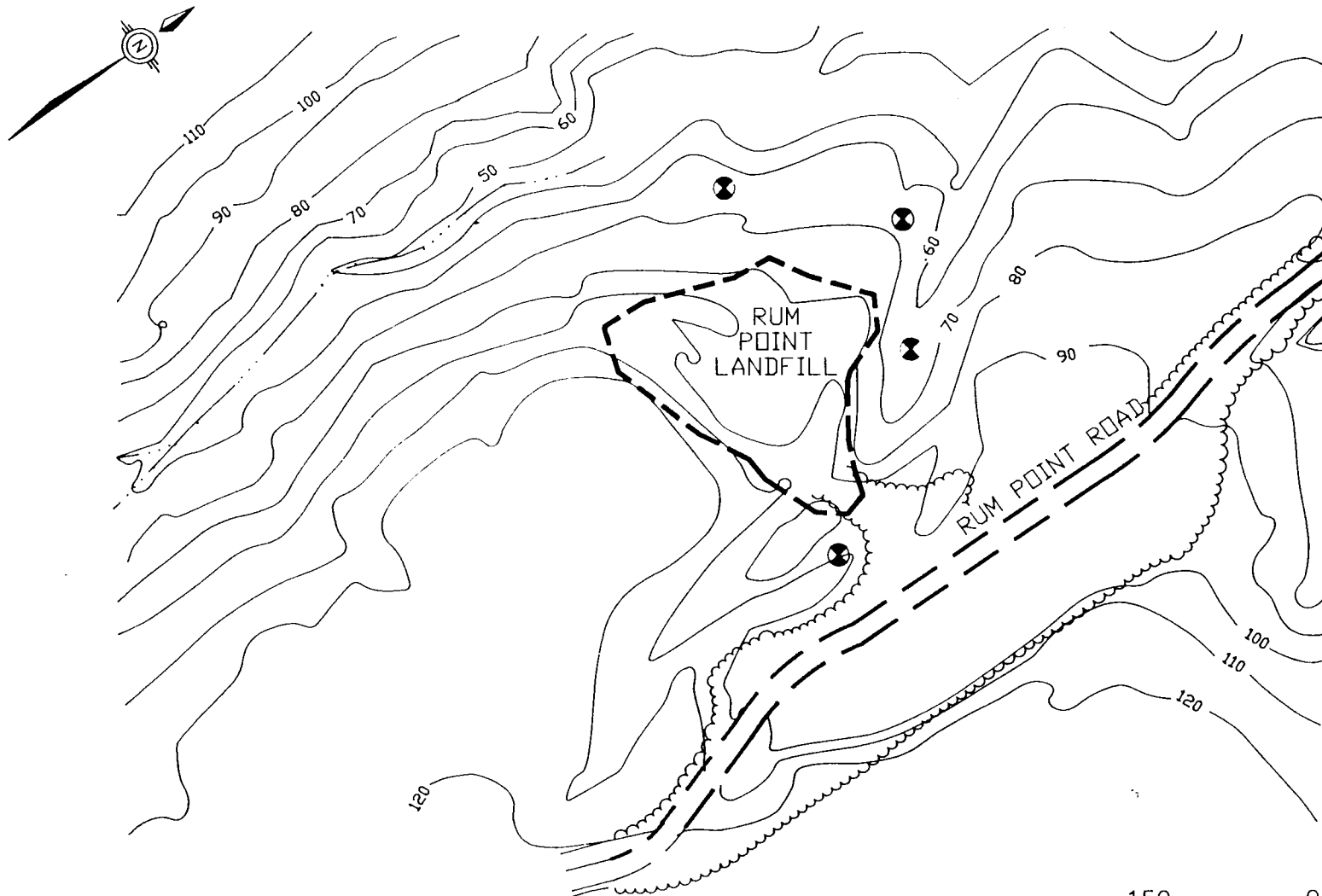
4. Assess routes of potential contaminant migration.
5. Identify potential receptors.

All fieldwork will be completed under CHESDIV directive. Specific sampling protocols for field activities are detailed in Section 5.

#### **4.1 Rum Point Landfill Sample Locations and Rationale**

Four monitoring wells proposed for the Rum Point Landfill are presented in Figure 9; three downgradient wells and one upgradient well. There is a 20- to 30-foot drop to a wooded area on the northwestern edge of the landfill. The downgradient monitoring wells will be installed in this wooded area at the base of the slope. The upgradient well will be installed topographically upgradient and outside of the landfill boundary. Because groundwater flow data are not available, the proposed well locations have been located assuming groundwater flows toward the stream west of the landfill. If it is later determined that groundwater flows in a different direction, the locations of the wells will be adjusted accordingly. An all-terrain vehicle (ATV) drilling rig will be required for their installation. Continuous split-spoon-soil samples will be collected during boring advancement for lithologic interpretation. Samples collected at 5-foot intervals will be submitted for laboratory analysis. One Shelby tube will be collected from the consolidated sediments at each well location. One soil sample will be collected from the screened interval for grain size analysis. One sediment sample will be collected from the stream bed downstream of the landfill. The exact sampling location will be selected during the investigation. If waters in the stream, a surface water sample also will be collected. All soil and water samples from Rum Point Landfill will be analyzed for the following 40 CFR 264 Appendix IX constituents:

- Metals
- Volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs)



### LEGEND

- UNPAVED ROAD
- 10' CONTOUR
- ~~~~~ WOODED AREA
- STREAM
- ⊗ MONITORING WELL

SOURCE: USN BUREAU OF YARDS AND DOCKS  
AREA PUBLIC WORKS OFFICE, CHESAPEAKE  
WASHINGTON, D.C. DWG. 1029307

150 0 150  
SCALE FEET



VERIFICATION INVESTIGATION  
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FIGURE 9  
RUM POINT LANDFILL  
PROPOSED WELL LOCATIONS

DATE: 09/13/95

DWG NAME: 4RPLWL

#### **4.2 Air Blast Pond Sample Locations and Rationale**

Testing at the Air Blast Pond will consist of three shallow soil samples within the former blast pond, four shallow soil borings on the periphery of the pond, and three sediment samples from the effluent ditch (Figure 10). If water is in the effluent ditch, a surface water sample also will be collected. All soil and water samples collected from the Air Blast Pond will be analyzed for the following 40 CFR 264 Appendix IX constituents:

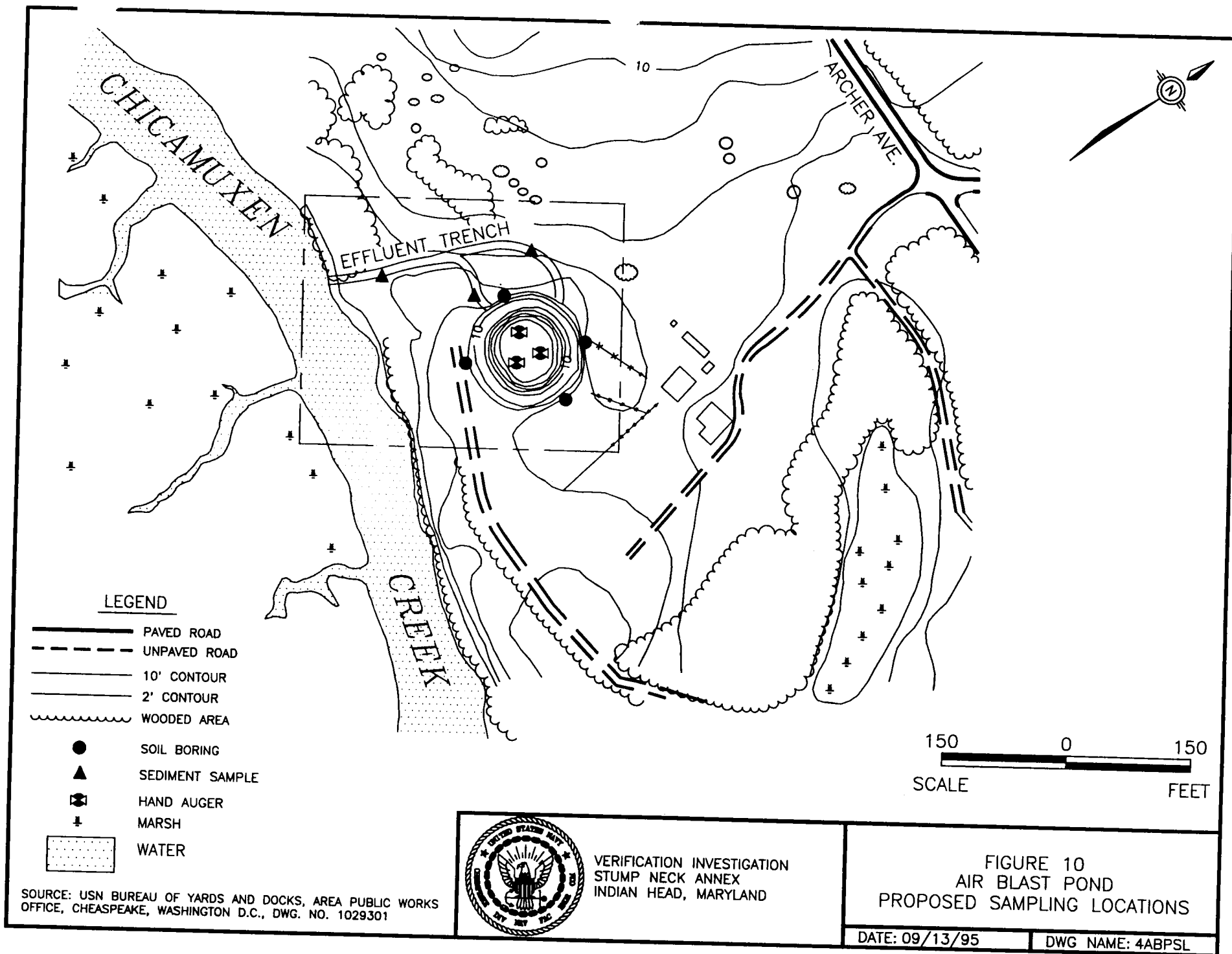
- Metals
- VOCs and SVOCs
- Trinitrotoluene (TNT)
- Cyclotrimethylenetrinitramine (RDX)
- Cyclotetramethylenetetranitromine (HMX)

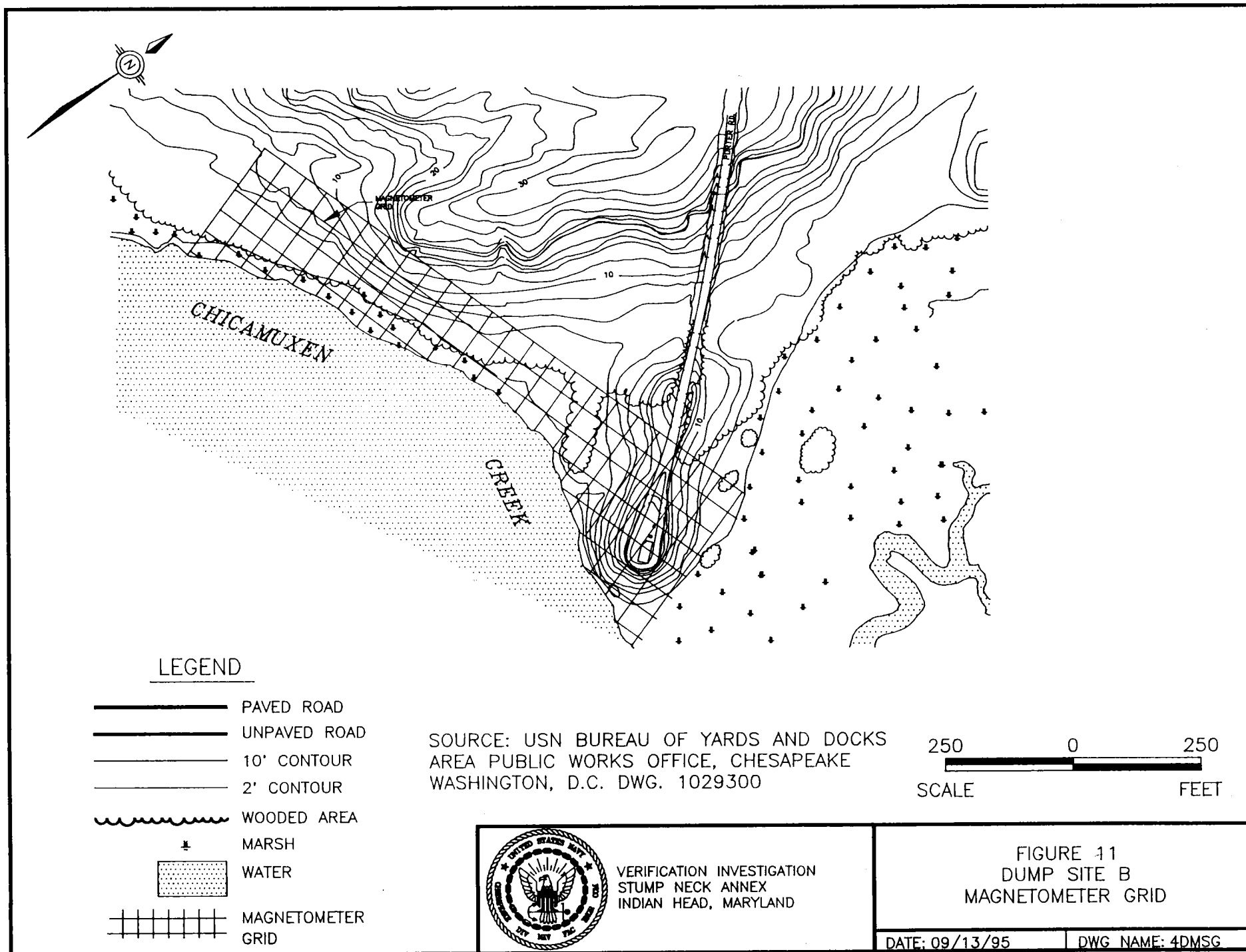
#### **4.3 Chicamuxen Creek's Edge Dump Site B Sample Locations and Rationale**

The exact location of Chicamuxen Creeks Edge Dump Site B is unknown. The suspected site location will be surveyed using a magnetometer. The survey area (Figure 11) will be divided into a 10-foot by 10-foot grid. Readings will be taken along the survey lines. If anomalous readings are detected, the outer periphery of the area will be plotted on the grid map. Sampling locations can be established based on the survey results.

This method was chosen because of the type of waste deposited in the dump. According to an Outbrief of 10/5/90, inert metal ordnance, a barbette metal ring, inert metal bomb cases, and projectile cases were dumped at this site. Currently, random soil samples would not provide adequate information to assess this site. If the magnetometer survey identifies the boundaries of the dump, then surface soil samples will be collected using hand-auger techniques. However, before sampling, a site-specific addendum to the approved VI will be submitted for review.







If collected, all soil and water samples from Chicamuxen Creek's Edge Dump Site B will be analyzed for the following 40 CFR 264 Appendix IX constituents:

- Metals
- VOCs and SVOCs
- TNT
- RDX
- HMX

Quality Assurance/Quality Control (QA/QC) procedures and laboratory deliverable requirements are detailed in Section 6.

#### **4.4 Aquifer Testing**

The shallow aquifer system at Stump Neck will be preliminarily characterized by conducting specific capacity tests or slug tests on each of the site wells if groundwater contamination is identified. The procedures for conducting specific capacity and slug tests are provided in Section 5.

Full scale constant rate aquifer testing (if necessary) will be performed as part of corrective measures implementation and will not be performed as part of the VI.

#### **4.5 Quality Assurance Plan (QAP)**

The Quality Assurance Plan is designed to ensure the QA/QC for sampling and record-keeping at the investigation sites. The QAP, Section 6.0, discusses the data quality objectives (DQOs), sample documentation and chain-of-custody records.

## **5.0 SAMPLING PROCEDURES**

This section details the various survey and sampling techniques proposed for the VI. Decontamination procedures and investigation-derived wastes (IDW) are also discussed.

### **5.1 Magnetometer Survey**

The magnetometer survey will be conducted at Chicamuxen Creek's Edge Dump Site B to identify buried metallic objects, if present, which will aid in preliminarily delineating the dump boundary. The magnetic field strength, measured by the detector as a magnetic signal intensity, varies between  $1/r$  and  $1/r^3$  ( $r$  being the distance from the sensor to the buried object), depending upon the type of object. Metal location and depth of burial are indicated by the shape and width of the anomaly. The accuracy of this method is within 40% of the interpreted value. Total field and vertical gradient measurements are two types of magnetic surveys. The following setup procedures apply to both types of surveys.

#### **Setup Procedures**

1. Review past disposal practices to identify target and nontarget areas.
2. Determine the minimum size of target to be identified.
3. Identify areas of potential magnetic interference (e.g., metal fences, metal buildings, power lines).
4. Review the site geology to determine if any geologic anomalies might interfere with target detection.
5. If anomalies are expected, estimate their intensity.
6. Establish a sampling grid or transect across the site. The distance between sampling points depends on the resolution required for a particular site and the estimated size of the target. The closer the sampling points are to each other, the greater the resolution.

Use a nonmetallic marker such as a wooden stake to identify stations. If possible, establish the grid so the lines are perpendicular to the target axes. If not, align the grid north to south or anchor it to a permanent site feature.

7. Check the calibration date of the magnetometer. If it has not been calibrated for more than one year, return the instrument for recalibration.

### **Total Field Measurement Survey**

The total field measurement is a scalar measurement of the total magnetic field intensity. The person operating the magnetometer must be free of any potentially magnetic material (e.g., steel-toe boots).

### **Survey Procedures**

1. Place the magnetometer at a station, properly orient the sensors, and collect the reading in accordance with the manufacturer's operating manual.
2. Hold the magnetometer approximately 0.5-meters above the ground surface to obtain a reading. At subsequent grid nodes, the magnetometer must be held at the same height above the ground surface. A 0.5-meter mark on a staff may be used to estimate this height.
3. Record the magnetometer reading, measurement time, grid node identification, and applicable comments in the field logbook.

### **Vertical-Gradient Field Measurements**

The vertical-gradient field measurement consists of two or more total field measurements taken at different sensor heights. This helps quantify regionally pervasive magnetic effects from nearby building or ubiquitous bedrock magnetization.

**Survey Procedures:**

1. At each grid node, collect total field measurement at 0.5-meters above the ground surface.
2. Collect a second reading with the sensor approximately 1 to 2 meters above the point where the first reading was taken. A staff will be designed to hold the two sensors so separation remains constant.
3. Record the second value and the distance between readings.
4. Record any additional comments in the field logbook.
5. Collect readings at the remaining grid nodes with the same distance between the first and second readings.

In most cases, drift and sudden fluctuations in the earth's magnetic field intensity must be corrected using one of two methods. The first uses a "tie base station" at which measurements are repeated at least once an hour. The data obtained between repeats at the base station can then be corrected by a linear interpretation. The second uses a second magnetometer to continuously monitor the magnetic field. The data are then corrected manually or by software in digital magnetometers. Method 2 is more costly but more accurate, and is sometimes necessary in active parts of the 11-year solar cycle.

**5.2 Soil Sample Collection Procedures**

Soil samples will be collected from hand auger borings and soil borings installed by drilling. Sections 5.3, 5.4, and 5.5 discuss the sampling tools and procedures for collecting samples.

- Sample collection will proceed progressively from the least contaminated area to the most contaminated area.

- A clean pair of gloves will be worn each time a sample is collected.
- After the sampling tool is removed from the target interval, soil for the VOC analysis will be removed with a decontaminated stainless-steel spoon and immediately placed in the appropriate sample container, thus reducing the potential for contaminant volatilization. The soil will be packed into the sample container with zero headspace to further reduce the risk of volatilization during transit to the lab.
- The remaining sample will be screened with a photoionization detector (PID) to detect any volatile compounds (if present).
- The remaining sample will be removed from the sampling tool with a stainless-steel spoon and placed in a decontaminated stainless-steel bowl.
- The soil in the bowl will be thoroughly homogenized with the stainless-steel spoon, then placed in the appropriate sample containers.
- The sample containers will be labeled with the sample identification number, date and time of collection, project name and number, and type of preservative.
- The labeled sample containers will be placed in an ice filled cooler.
- At the end of the day, the samples will be packed on ice in a cooler and shipped via overnight courier to the laboratory for analysis.

### **5.3 Hand-Auger Sampling Procedures**

Hand augers will be used to obtain surface and shallow subsurface soil samples. A hand auger consists of a stainless steel sand or clay bucket connected to 3-foot, stainless-steel rods which can be attached to each other. A curvilinear cutting edge welded onto the bottom of the bucket allows soil to enter the bucket as it is twisted into the ground, and prevents the soil from

spilling. Soil samples will be collected from the auger buckets using stainless steel spoons or spatulas following the procedures described in Section 5.2.

Soil samples will be described and pertinent information recorded on a boring log. All field observations and soil descriptions will be recorded in the dedicated field logbook. Once the samples have been collected, the auger hole will be backfilled with soil or grout, if needed.

Samples will be collected as follows:

1. Don appropriate personal protect in equipment (PPE).
2. Spread clean plastic sheeting on the ground near the sample collection location to set up decontaminated sampling equipment.
3. Set up a decontamination area for sampling equipment, if required.
4. Begin augering to the depth required for sampling.
5. Stop drilling at the top of the specified or selected sampling depth.
6. Collect samples using the following the procedures described in Section 5.2.
7. Proceed with additional sampling, as required by the site-specific sampling plan.
8. Backfill the borehole with the excess soil or grout.
9. Decontaminate all equipment.



#### **5.4 Soil Borings/Monitoring Wells**

To meet the objectives of the VI, eight soil borings will be installed during the field sampling program, with four borings at the Rum Point Landfill being completed as monitoring wells.

Due to the presence of subsurface obstructions (i.e., riprap) three types of drilling methods are proposed: hollow-stem auger, mud rotary, and casing rotary. These methods may vary with each site. Hollow-stem auger is the preferred method for the field investigation. However, if subsurface obstructions preclude the use of hollow-stem augering, an alternative technology may be required. Mud rotary will be used if "heaving" sands (which impede successful auger drilling) are encountered. Casing rotary may be successfully employed to advance casing through riprap. These drilling technologies are further detailed below.

##### **Hollow-Stem Auger**

Hollow-stem augering is a power technique used to advance a borehole to sample. The auger consists of tubing with spiral flights attached on the sides and a cutting head secured on the bottom. A continuous core sampler is attached to drill rods and held at the cutting head to prevent soil from rising in the annulus of the augers. The auger is turned and advanced and sections are added as the depth increases. When the desired sampling depth or well completion depth is reached, the drill rods and core sampler are removed. The augers act as a casing to prevent the sides from collapsing. Sampling and well installation can be conducted through this protected annular space. Hollow-stem augering is best suited to stable sand, clay, and/or silt. It is not well-suited to gravel, hard dry soils, or saturated sands under hydrostatic pressure.

##### **Mud Rotary Drilling**

Mud rotary drilling is well-suited for unsaturated or saturated, unstable sand and gravel. The hole is advanced by means of a roller, drag, fish tail, or tri-cone bit attached to a hollow drill rod. The mud, consisting of a potable water and sodium bentonite slurry, is pumped through the drill bit, forcing the cuttings up through the annular space of the borehole. The head

pressure of the slurry prevents the hole from collapsing. The integrity of the hole is also improved as the mud cakes on the walls. At the prescribed depth, the drill bit is removed and the split spoon sampler is attached and sampling, as described in Section 5.5 is implemented. Drilling will continue once the sample is collected and the split-spoon sampler is removed.

### **Casing Rotary**

Casing rotary may be feasible if unconsolidated riprap, and or fill rocks are encountered. The hole is advanced through the fill by using a cutting shoe and tri-cone rotary bit attached to a hollow steel casing. The appropriate diameter of the cutting shoe, tri-cone rotary bit and the hollow-stem augers will be determined at the site. As the casing rotates, the bit cuts through the fill material. Potable water is poured down the hole during the drilling process to provide lubrication. Once the soil below the fill is reached, the tri-cone bit is removed, the casing is left in place, and drilling is continued with a hollow-stem auger or by mud rotary drilling.

Samples will be collected at the prescribed depths with a split-spoon sampler. The sampling method is described in Section 5.2. Regardless of the drilling method used, clean plastic sheeting will be spread on the ground around the borehole to prevent potentially contaminated soil or formation water from being brought to the surface.

### **5.5 Soil Boring Sampling Procedures**

Soil borings will be advanced using one of the drilling methods described in Section 5.4, then samples will be collected from each proposed boring location. The samples will be collected using a standard 2-inch diameter, 24-inch split-spoon sampler or a 4-inch diameter, 5-foot continuous soil sampler.

The split spoon consists of a cylindrical metal tube made up of two pieces, each completed with threaded ends. A cutting shoe is attached to the bottom end of the tube, and the other is attached to the drill rods. The device is lowered through the center of the hollow-stem augers

or down the drill hole. At the correct sampling depth, a standard weight 140-pound hammer dropped 30 inches drives the spoon 24 inches into the natural soil ahead of the drill bit. The split-spoon may also be pushed hydraulically where the soil density will allow.

The 5-foot continuous sampler is constructed similarly to the split spoon. It is a cylindrical metal tube made up of two halves with threaded ends. A cutting shoe is attached to the bottom end of the tube, and the other end is attached to the drill rods. The continuous sampler is lowered through the augers a few inches ahead of the cutting head. The sampler locks in place and advances with the augers. This fills the sampler with undisturbed soil as the borehole is advanced.

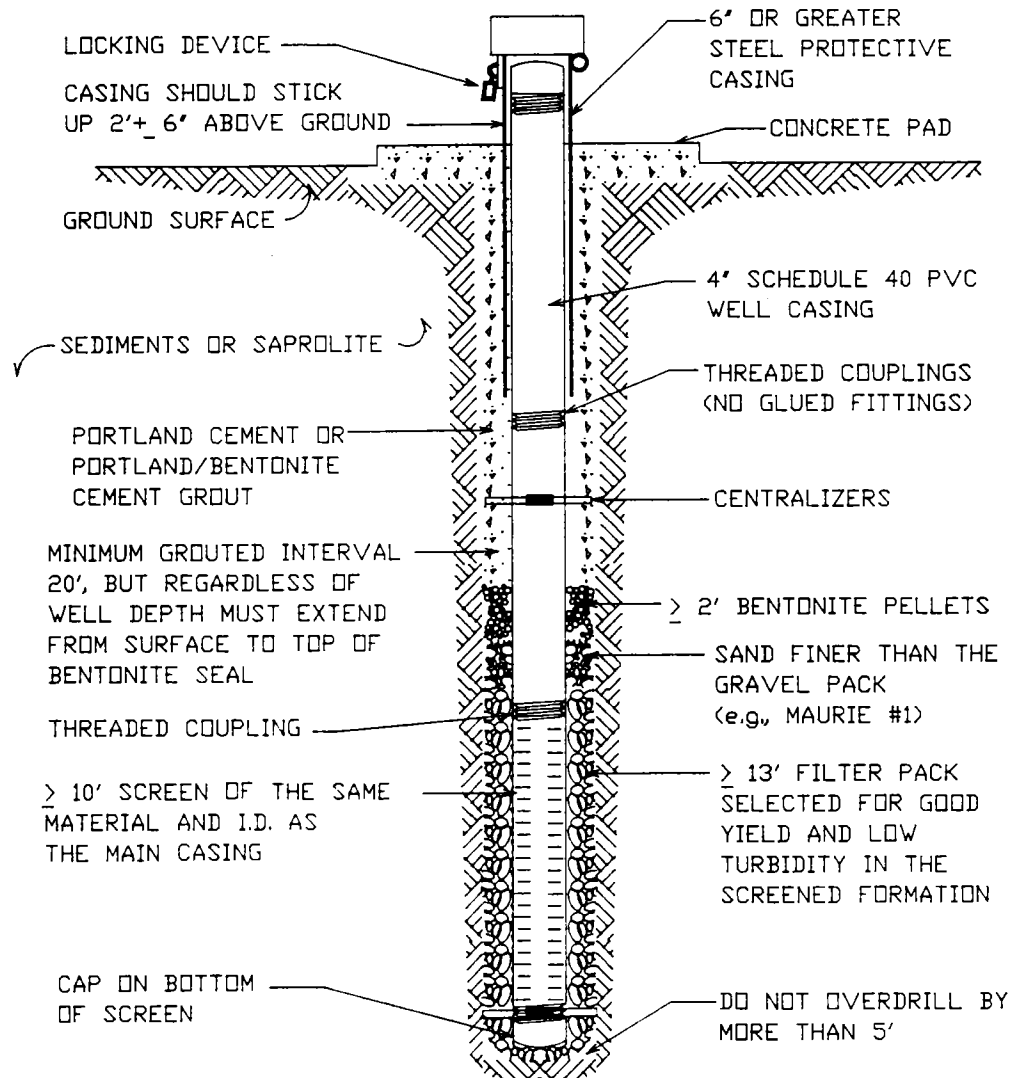
The split-spoon or continuous sampler containing the sample is removed from the hole, detached from the drill rod and carefully opened by the site geologist. The sample will be immediately removed with stainless-steel spoons, scoops, or disposable scoops and processed by the site geologist for analysis following the procedures described in Section 5.2. A PID reading and lithology will be recorded directly from the sample before placing portions into appropriate sample containers. Sample lithology will be carefully described and recorded during processing.

## **5.6 Monitoring Well Installation**

The soil borings advanced at the Rum Point Landfill will be completed as groundwater monitoring wells. Sampling will be conducted as discussed in Sections 5.2 and 5.3. All groundwater monitoring wells will be designed and installed according to the MDE regulations. Figures 12 and 13 are adapted from the Maryland Well Construction Regulations, COMAR 26.04.04, and represent the two well types anticipated for the field investigation.

In each well, the screen consists of a 4-inch diameter, 10-foot long Schedule 40 polyvinyl chloride (PVC) 10 slot (0.010") continuous well screen. The riser consists of 4-inch diameter Schedule 40 PVC riser pipe. If nonaqueous phase chlorinated compounds are observed during

STATE OF MARYLAND  
DEPARTMENT OF THE ENVIRONMENT  
HAZARDOUS AND SOLID WASTE MANAGEMENT ADMINISTRATION  
TYPICAL ILLUSTRATION OF MINIMUM SPECIFICATIONS  
FOR MONITORING WELL CONSTRUCTION



'>' MEANS 'GREATER THAN OR EQUAL TO'  
WELL REGULATIONS, MINIMUM SPECIFICATIONS, AND SPECIFIC  
INSTRUCTIONS BY HSWMA SUPERCEDE THESE GENERAL REQUIREMENTS.

SOURCE: STATE OF MARYLAND, DEPARTMENT OF THE ENVIRONMENT  
HAZARDOUS AND SOLID WASTE MANAGEMENT ADMINISTRATION



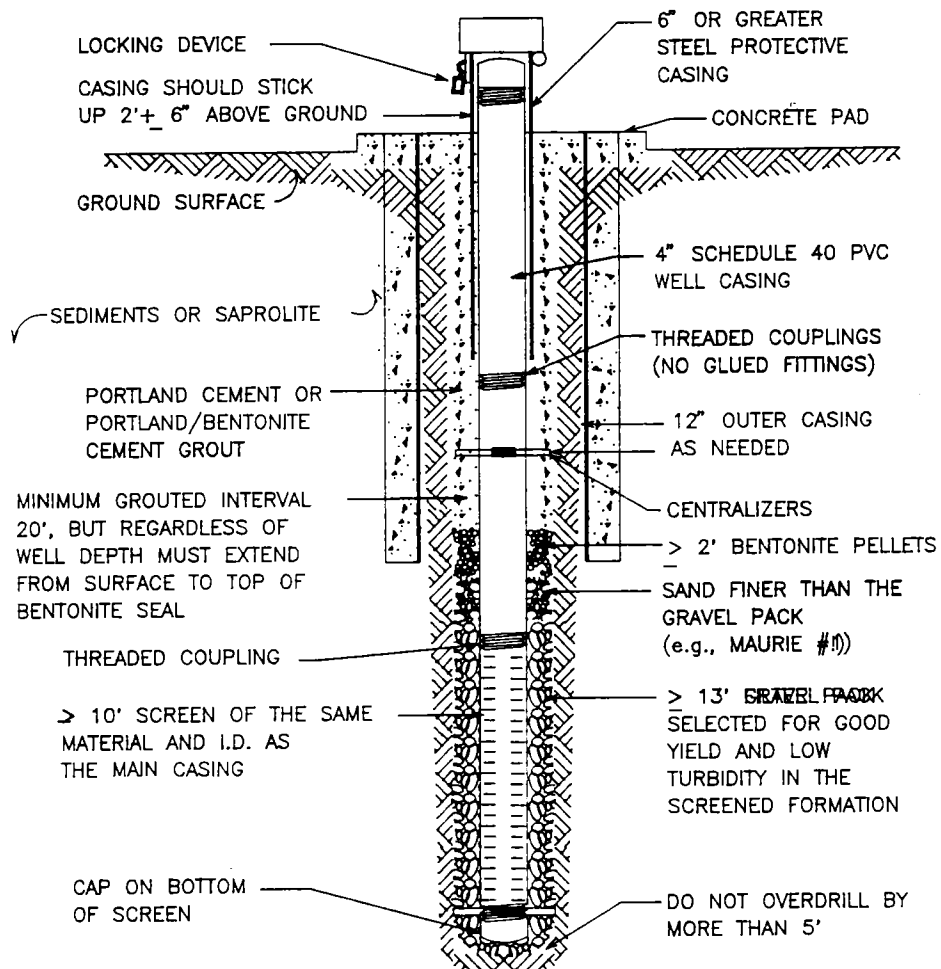
VERIFICATION INVESTIGATION  
STUMP NECK ANNEX  
INDIAN HEAD, MARYLAND

FIGURE 12  
MONITORING WELL DESIGN

DWG DATE: 09/13/95 DWG NAME: 4MWDS09

STATE OF MARYLAND  
DEPARTMENT OF THE ENVIRONMENT  
HAZARDOUS AND SOLID WASTE MANAGEMENT ADMINISTRATION

TYPICAL ILLUSTRATION OF MINIMUM SPECIFICATION  
FOR MONITORING WELL CONSTRUCTION



">" MEANS "GREATER THAN OR EQUAL TO"  
WELL REGULATIONS, MINIMUM SPECIFICATIONS, AND SPECIFIC  
INSTRUCTIONS BY HSWMA SUPERCEDE THESE GENERAL REQUIREMENTS.

SOURCE: STATE OF MARYLAND, DEPARTMENT OF THE ENVIRONMENT,  
HAZARDOUS AND SOLID WASTE MANAGEMENT ADMINISTRATION



VERIFICATION INVESTIGATION  
STUMP NECK ANNEX  
INDIAN HEAD, MARYLAND

FIGURE 13  
MONITORING WELL DESIGN  
THROUGH REFUSE

DWG DATE: 09/13/95 DWG NAME: 4MWDR10

groundwater sampling, the PVC wells may be abandoned and replaced with stainless-steel wells. A minimum of three stainless-steel centralizers will be attached to the well: one near the bottom and the middle, and the third just below ground surface. When a plug is not needed to block the augers, the riser pipe and screen are lowered into the annulus until they reach the prescribed depth at the bottom of the augers. A well-graded silica sand intended for use in monitoring wells and larger than the screen slot size is backfilled around the well screen with a tremie pipe for a homogeneous filter pack. The tremie pipe consists of either a 1- or 2-inch seamless, threaded joint PVC pipe. The augers are slowly raised as the sand is tremied into place.

When an auger plug is used, the well pipe, tremie pipe, and the drill rods are all lowered to the bottom of the augers. Approximately 2 feet of sand is tremied onto the plug as a filter against inflowing sediment. The augers are then raised approximately 6 inches and the plug is knocked out with the drill rods. The drill rods are removed and the filter pack is tremied into place as the augers are slowly raised. The final depth of the top of the filter pack will extend to at least 2 feet above the top of the well screen.

Another layer of sand, finer than the filter pack, will be tremied above the filter sand. A bentonite seal, at least 2 feet thick, consisting of bentonite pellets (0.25 to 0.5-inch size) is emplaced with a tremie pipe on top of the filter pack. The bentonite seal is allowed to hydrate for at least eight hours prior to grouting. The depths to the top of the filter pack and the top of the bentonite seal are confirmed by measuring with the tremie pipe or a weighted steel measuring tape. After the bentonite seal has hydrated for at least eight hours, the remaining annular space around the well pipe is grouted with a mixture consisting of Portland cement with 4% to 5% bentonite powder. The grout will also be emplaced by tremie pipe.

After installation, the wells will be completed as aboveground wells or as flush-mount wells. The following describes the well completion procedures:

1. For flush-mount wells, the well casing will be cut level with the ground surface. A steel protective manhole cover will be set over the well pipe in the curing well grout. For aboveground completions, the casing will extend approximately 2.5 feet above the ground surface. A square, steel protective cover with locking lid will be set over the casing into the curing grout. A concrete pad (4' x 4' x 0.5') that slopes away from the well cover is completed around the wellhead.
2. All monitoring wells will be surveyed by Maryland-registered land surveyor to the nearest 0.01-foot incorporating a U.S. Geological Survey (USGS) benchmark. Reference to this survey will be clearly stated on all plats, drawings, and figures along with the benchmark reference. A permanent mark will be placed atop each well casing to aid in generating accurate and consistent groundwater measurements.
3. All monitoring well installation notes, calculations, descriptions, and observations will be recorded in the field logbook. In addition, soil boring and well construction logs will be produced that depict all construction details of the finished wells. These construction details include total depth, date completed, lithology where sampled, depth to the filter pack and the seal, and a measured static water level.
4. Well development will be conducted after the cement grout in the annulus of the monitoring well has cured at least 24 hours. Well development is required to remove the fine clay and silt particles from the filter pack emplaced against the well screen. Development ultimately reduces turbidity in the groundwater samples and proceeds until groundwater turbidity has been minimized. The techniques discussed in Section 5.7 may be used alone or in combination to develop the wells.

## **5.7 Well Development**

Prior to groundwater sampling all monitoring wells will be developed. Well development will be accomplished by bailing, surge block, and/or pumping/overpumping/backwash. Techniques may be combined to ensure that turbidity is minimal in the developed wells.

**Bailing:** The bailer is allowed to fall to the bottom of the well. Water is displaced into the formation as the bailer strikes the groundwater surface and falls through the water column to the bottom of the well. The influx of water into the filter pack breaks up any bridging of fine particles which may have occurred during well construction. When the bailer has filled with water and sediment, it is rapidly withdrawn and the contents are containerized for disposal. The backsurge from removing the bailer causes water to flow back into the well, further removing fines from the filter pack. The fine particulate matter suspended in the water is removed in the bailer. The bailing process is repeated until water turbidity is minimal.

**Surge Block:** The surge block is operated as a part of the drill rod or on the end of a 1-inch-diameter PVC riser pipe. The circular surge block fits snugly inside the well to prevent water from flowing around its outside. A bypass valve in the center allows water to flow through the block. The block attached to the rod is pushed to the bottom of the well and alternately raised and lowered along the length of the well screen. The block's movement forces water into the filter pack on the downstroke and pulls it out on the upstroke. The surging action breaks up particles in the filter pack and pulls them into the well. The process is repeated several times and, after removing the block, the water and fines are pumped or bailed from the well.

**Pumping/Overpumping/Backwashing:** Pumping removes water which is replaced from the formation. Water moving through the formation and the filter pack dislodges silt and clay-sized particles, which are carried into the well and removed with the pumped water when the pump is turned off, the recharge flow velocity increases as the well is recharged. The higher flow velocity flushes more particulates into the well, where they can be pumped out. When no backflow prevention valve is installed, the pump draws water up into the pipe. When the pump is turned off, the column of the water falls down the pipe, causing water to surge back into the filter pack and the formation. The resulting back-surfing action breaks up additional bridged particulate matter, which can be removed by the pump during the next pumping cycle.



Groundwater will be pumped during development using one or more of the following pumping devices.

#### **Pumps**

- Electric submersible pump
- Air lift pump
- Hand-activated vacuum lift pump
- Pneumatic pulse displacement pump
- Perisaltic pump
- Bailer

Water quality parameters will be frequently measured during well development. A portable water quality indicator will be used to measure pH, conductivity, temperature, and turbidity. These measurements will be recorded in the field logbook and development will be completed once the water quality parameters have stabilized. These parameters will also be measured and recorded during well purging, described in Section 5.8.

#### **5.8 Well Purging**

Each well will be purged of at least three well casing volumes prior to sampling. Purging removes stagnant water from the well, and ensuring that a sample representative of the groundwater in the screened aquifer is collected. Prior to purging, clean plastic sheeting will be spread on the ground around the well, volatiles will be measured at the well-head with a PID to help identify potential immiscible layers, and groundwater levels will be measured with a precleaned electronic water level indicator. These measurements will be used to calculate the volume of water in the well casing. The volume of water is calculated using the following formula:

$$V = h_1 - h_2 \times 0.65$$

Where:

- V = volume of water
- $h_1$  = total depth of the well
- $h_2$  = static water level
- 0.65 = a constant converting linear feet of water in a 4-inch well to gallons

After calculating the volume, the well can be purged with a Teflon bailer or peristaltic pump.

The pH, temperature, conductivity, and turbidity of the water will be measured after each well volume is purged. These measurements will be recorded on a well sampling sheet or in the field logbook. The well will be considered purged when three consecutive readings of each water quality parameter have stabilized. Goals for stability are:

- pH  $\pm 0.5$  standard units
- Conductivity  $\pm 10\%$
- Temperature  $\pm 1^\circ\text{C}$
- Turbidity  $< 10$  Nephelometric Turbidity Units (NTUs)

A turbidity value of less than 10 NTUs may not be obtained in very silty or clayey aquifers. However, if turbidity is higher than 10 NTUs but stable, purging will be considered complete.

If a well is pumped or bailed dry during purging, it will be allowed to recharge to its original static water level or for 24 hours. After the well has recharged, it will be sampled as follows.

### **5.9 Immiscible Layers**

Prior to purging, all wells will be monitored for immiscible layers in accordance with the *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*. The monitoring requires the following steps:

1. Remove the locking and protective caps.
2. Sample the air at the well head for the presence of organic vapors using a PID.
3. If immiscible layers are present, measure the liquid level and record depth and thickness using an interface probe. Record all measurements.

Immiscible layers are not expected; however, if they are encountered a sample will be collected and submitted for laboratory analysis. Analytical parameters will include those constituents specific to the corresponding SWMU. If no immiscible layers are identified, the well will be sampled as previously outlined.

#### **5.10 Groundwater Sampling**

Water samples will be collected to identify contaminants, identify the migration pathways, and to delineate the contaminant plume, if present. Groundwater sampling will begin at least 24 hours after well development. If the plastic sheeting was heavily soiled during well purging, clean plastic will be placed on the ground to reduce the potential of equipment cross-contamination from the ground or spilled stagnant purge water.

Groundwater samples will be collected from each monitoring well with a peristaltic pump and transfer bottle, or a bailer. The samples will be collected in pre-cleaned 40-ml septa vials and 1,000-ml glass jars, both with Teflon-lined lids. All samples will be preserved to 4°C ( $\pm 2^\circ\text{C}$ ). Samples intended for VOC analysis will be preserved with HCl (pH < 2). Samples for metals analyses, both dissolved and total, will be preserved in HNO<sub>3</sub> (pH < 2). No chemical preservative is required for HMX, RDX, and TNT; however, the compounds are thought to be photosensitive, so amber jars will be used.

Groundwater samples collected using a bailer will be collected in accordance with the procedures outlined below:

1. Securely attach the bailer to a clean cotton or nylon line. The end of the line should be secured so the bailer is not lost down the well.
2. Arrange the sample containers in the order of sample collection. VOC samples will be obtained first, followed in order by SVOCs and other samples.
3. Lower the bailer into the water slowly to prevent volatilization and agitation, particularly when VOC and SVOC samples are being collected.
4. Retrieve the full bailer to the surface. Do not allow the line to touch the ground.
5. Unless the same bailer is used for both purging and sampling, use the first bailer of water as rinse, discarding the water into a clearly marked drum.
6. Repeat steps 3 and 4.
7. Either fill the VOC vials from the top of the bailer or attach VOC bottle filler to the bailer's base. For VOC samples, tilt the sample bottles when filling to prevent aeration. Cap the vial when full, then check for bubbles making sure the vial has zero headspace.
8. If the water remaining in the bailer is insufficient to completely fill another container, discard the water. Lower the bailer again to collect more water for additional sample volume.
9. Fill the remaining sample containers to capacity. Add preservative (if needed), cap, seal, and properly label all containers. Place the filled containers in the cooler(s) immediately and chill to 4°C ( $\pm$  2°C).

10. Record sample identifications, types and amounts collected, and the time and date of collection in the field logbook and/or on the groundwater sampling form. Prepare the chain-of-custody form.
11. Decontaminate or discard sampling equipment if it is not dedicated to the monitoring well.
12. Clean up the area and place disposable materials (plastic sheeting, gloves, cord, etc.), in the designated drum for disposal by the Navy.
13. Close and lock the well cover.

Groundwater samples collected using a peristaltic pump will be collected in accordance with the procedures outlined below:

1. Collect groundwater samples as monitoring well recharge allows.
2. Collect samples using a decontaminated peristaltic pump with dedicated Teflon tubing and in-line collection/transfer bottle.
3. Measure temperature, pH, specific conductance, and turbidity for each sample collected and record results in the field logbook or on the groundwater sampling form.
4. Chemically preserve samples. After chemical preservation and labeling, chill the samples to 4°C.
5. Record weather conditions at the time of sample collection in the field logbook. Refer to specific procedures for groundwater sample collection provided below.

**Before Groundwater Sampling:**

1. Don protective clothing and equipment as specified in the HASP.
2. Prepare the site by covering the ground surface around the wellhead with plastic sheeting and arrange the required sampling equipment for convenient use. If onsite decontamination is required, arrange the necessary supplies in a separate nearby location, away from the wellhead.
3. Open the well cover and immediately insert the PID or FID into the wellhead to measure ionizable organic vapors for approximately 1 minute. If vapors are detected, an interface probe will be used to determine the thickness of free product, if present. If product is present, a one-way check ball valve will be used to sample the layer.
4. Measure static water level and total depth of the monitoring well to the nearest 0.01 foot using an electronic water-level indicator. Record the measurement in the field logbook or on the groundwater sampling field form. Calculate the static water volume.
5. Insert the dedicated, decontaminated 1/4-inch-diameter Teflon tubing down the monitoring well to immediately below the groundwater surface for purging. Connect the tubing to the peristaltic pump's dedicated, decontaminated silicon tubing. Attach the silicon tubing to the pump's intake valve. Additional silicon tubing will be connected to the pump and used as an effluent hose. All effluent will be containerized as IDW.
6. Begin purging the well at approximately 0.05 to 0.25 gallons per minute (gpm).
7. During purging, monitor the purge volume, time, purge rate, temperature, pH, conductivity, and turbidity. Record the measurements on the groundwater sampling form or in the field logbook. Continue purging until at least three well volumes are removed and when temperature, pH, conductivity, and turbidity have stabilized. Turn off the pump.
8. Arrange the sample containers in the order of sample collection. VOC samples will be obtained last, proceeded by samples for explosives, SVOCs, and metals.

**During Groundwater Sampling:**

9. Immediately following well purging, collect the groundwater sample. Using the same peristaltic pump and tubing, connect the in-line collection/transfer bottle apparatus. The apparatus consists of a two-aperture Teflon cap attached to a dedicated 300 series laboratory-certified, 80-ounce glass bottle. The two-aperture cap and bottle are attached to the Teflon tubing before it reaches the peristaltic pump.
10. The peristaltic pump is then turned on, creating a vacuum in the collection/transfer bottle sufficient to lift the groundwater from the well and filling the bottle at a low controlled flow rate (approximately 0.05 to 0.25 gpm).
11. Groundwater collected in the bottle is immediately transferred to appropriate BNAs, PCBs, cyanide, and metals sample containers. VOC samples will be collected using the technique provided below.
12. Turn the pump off when sufficient volume is collected to fill all containers.
13. Remove the collection/transfer bottle system from the pump system. The downhole Teflon tubing is then connected to the pump and inserted in the monitoring well. Turn on the pump at a low flow rate and allow the monitoring well to be purged for approximately 1 minute.
14. Disconnect the Teflon tubing from the pump and remove it from the monitoring well.
15. Allow the unagitated groundwater volume retained in the line to flow backward into 40-milliliter VOA vials.
16. Add preservative (if needed), cap, seal, and properly label all containers. Place the filled containers in the cooler(s) immediately and preserve to 4°C.

**After Groundwater Sampling:**

17. Record sample identifications, types and amounts collected, as well as the time and date of collection in the field logbook and/or on the groundwater sampling form. Prepare chain-of-custody.
18. Decontaminate sampling equipment if it is not dedicated to the monitoring well.
19. Clean up the area and place disposable materials (plastic sheeting, gloves, rope) in the designated drum for disposal by the Navy.
20. Close and lock the well cover.

**5.11 Sediment Sampling**

Sediment samples will be collected from surface water bodies and dry land areas depending upon sampling objectives. Collection methods include dredging or scooping. Several general sampling precautions must be followed to provide a representative sediment sample and to minimize disturbance regardless of sampling technique.

**General Sediment Sampling Precautions:**

- Avoid sediment plumes and density currents.
- If sediment and surface water samples are to be collected at the same location, collect the surface water first.
- Sediment sampling locations may be accessed by wading or by boat depending upon water depth and the nature of the substrate. If wading to the sample location, approach from downstream to minimize sediment sample disturbance.

Specific procedures for sediment sampling by dredging and scooping are discussed below.



#### **5.11.1 Dredge Samples**

A Petite Ponar grab sampler will be used to collect dredge samples from under water. The sampler is a stainless-steel, clamshell-type scoop activated by a cantilever system. Procedures for operating the Ponar grab sampler are provided below.

##### **Before Sampling:**

1. Don personal protective clothing and equipment as required in the HASP.
2. Lock open the jaws of the decontaminated sampler.

##### **During Dredge Sampling:**

3. Lower the sampler into the sediment.
4. Release the tension on the rope, and close the jaws of the sampler.
5. Retrieve the sampler and open the jaws to collect the sediment sample.
6. The VOC sample will be collected immediately from the Ponar sampler and placed into the appropriate sample container. Fill to capacity to achieve zero headspace.
7. Place any remaining sample into a decontaminated stainless-steel bowl.
8. Repeat the process of sample collection until enough volume has been collected to make the necessary composite samples. Homogenize the samples and place in the appropriate sample containers using decontaminated stainless-steel implements.
9. Describe lithology of sample collected and the depth from which the sample was collected in the field logbook.

**After Dredge Sampling:**

10. Upon completion of the sampling, decontaminate all equipment in accordance with Section 5.16 of this work plan.

**5.11.2 Scoop Samples**

Samples from sediment deposited in shallow surface water bodies or dry areas where surface water formerly or intermittently will be collected with a decontaminated stainless-steel spoon and bowl. Procedures for scooping are provided below.

**Before Scoop Sampling:**

1. Locate the sample collection point on the site map and reference it appropriately in the field logbook.
2. Don personal protective clothing and equipment as required in the HASP.
3. Place clean plastic sheeting on the ground surface near the sample collection point to contain decontaminated sample collection equipment.

**During Scoop Sampling:**

4. Scrape the sediment surface with a decontaminated stainless-steel spoon or spatula to access a previously unexposed surface.
5. Scoop the sediment with a decontaminated stainless-steel spoon or spatula avoiding twigs, large rocks, and grass.
6. **For Grab samples:**
  - a. Homogenize the sample in a decontaminated stainless-steel, glass, or Teflon-lined bowl. Samples collected for VOC analysis will be placed directly into the sample container from the sampling device without homogenization.
  - b. Be sure to have zero headspace in the VOC sample container.

**For Composite samples:**

- a. Empty contents of the sampling device into a decontaminated stainless-steel or glass bowl. Collect enough sample to fill all of the sample containers.
  - b. Homogenize sample.
  - c. Place the mixture into the appropriate containers.
7. Secure container with Teflon-lined cap.
  8. Label each sample container with the appropriate information.

**After Scoop Sampling:**

9. Place the samples in a cooler and chill to 4°C ( $\pm 2^\circ$ ).
10. Record pertinent information in the field logbook.
11. Place contaminated disposable materials in a clearly marked drum for future disposal by the Navy.
12. Decontaminate sample equipment in accordance with Section 5.16 of this plan.

**5.12 Surface Water Sampling**

Surface water sampling will be collected from standing or surface water bodies that may have been affected by the activities of an investigation site. The sample will be collected either by placing the sample bottle in the surface water body or by using a Kemmerer sampling device. After selecting surface water sample locations, the number of samples to be collected at that point will depend on the following criteria:

- Water depth
- Type of water body (e.g., lake, stream, impoundment, wetland).

In cases where the water depth is greater than 3 feet, establish a generalized vertical profile (per foot of water) of water quality parameters (e.g., dissolved oxygen, temperature, pH, conductivity, salinity, and depth) before sample collection.

**General Surface Water Sampling Concerns:**

- Collect samples beginning in areas of least contamination and proceeding to areas of known or suspected contamination and from downstream to upstream.
- Approach surface water sample locations from downstream to minimize sediment disturbance.
- Collect the samples in a manner minimizing agitation of the underlying sediments.
- If surface water samples and sediment samples are to be collected at the same location, collect the surface water sample first.
- Determine the number of samples to be collected based on water depth at the sample location.
  - If the water is less than 1 foot deep, collect one sample at the surface.
  - If the water is greater than 1 foot, but less than 10 feet deep, the sample shall be collected at mid-depth.
  - If the surface water is greater than 10 feet deep, collect surface water samples at 1 foot depth, at mid-depth, and at 1 foot above the bottom.

Surface water sample collection procedures for both submerged bottle and Kemmerer devices are discussed below.

#### **5.12.1 Submerging Laboratory Bottle**

Surface water samples should be collected by submerging the sample container directly into a stream/lake. This preferred method is possible, however, only from a small boat, a pier, the shoreline, etc., or by wading into the stream [if the stream exhibits lotic conditions (running water) and allows sufficient access to collect a relatively sediment-free sample]. If conditions are not favorable, an alternative method should be used.

#### **Laboratory Bottle Sample Collection:**

1. Locate the sample collection point on a site map and describe in the field logbook.
2. Don personal protective clothing and equipment as required in the HASP.
3. Point the open end of the vials upstream. Slowly submerge unpreserved VOC vials completely into the water and fill. Do not disturb bottom sediments. If the sample is to be collected at depth, uncap the bottle at the required sampling depth. Recap the containers before returning the bottle to the surface.
4. Cap the VOC vial under water. Be sure to have zero headspace before sealing the vial.
5. If the VOC vials are prepreserved, collect the surface water sample using a decontaminated glass or stainless-steel device and carefully decant into the VOC vials.
6. Slowly submerge other unpreserved bottles into the surface water and fill. If the sample is to be collected at depth, uncap the containers at the required depth and allow to fill. Recap the containers before returning the sample to the surface.
7. Chemically preserve the samples as needed, and seal with a Teflon-lined cap.
8. Collect additional surface water in the sample collection device for field measurement of pH, temperature, and conductivity. If the sample interval is at depth, probes will be used to measure these parameters.

9. Place bottles in cooler and chill to 4°C ( $\pm$  2°C).
10. Note pertinent sampling information in the field logbook.
11. Decontaminate all sampling equipment in accordance with Section 5.16 of this work plan.

#### **5.12.2 Kemmerer Sampler**

Use a Kemmerer or similar sampling device when samples are needed at discrete intervals in a vertical water column. A Kemmerer is a cylinder with Teflon stoppers on the ends. The stoppers are open while the device is being lowered in a vertical position to allow free passage of water through the cylinder. When the Kemmerer has reached the designated sampling interval, a weight (messenger) is dropped down the rope to close the device. Specific procedures for surface water sampling with the Kemmerer sampler are provided below.

##### **Kemmerer Sampling:**

1. Locate the sample collection point on a site map and describe in the field logbook.
2. Don personal protective clothing and equipment as required in the HASP.
3. Determine the number of sample collection depths at the sample location.
4. Lower the decontaminated Kemmerer device to the designated depth.
5. Drop a messenger down the rope to close the cylinder.
6. Raise the Kemmerer device.
7. Immediately fill VOC vials. Make sure the sample has zero headspace, chemically preserve the sample if needed, and secure with a Teflon-lined cap.

8. Fill remaining bottles. If additional sample is needed, continue to collect sample at the designated depth until all bottles are filled.
9. Measure field parameters of pH, temperature, and conductivity and record in the field logbook at each sample depth.
10. Repeat procedure for each designated sample interval.
11. Place bottles in cooler and chill to 4°C ( $\pm$  2°C).
12. Note sampling information in the field logbook.
13. Decontaminate all sampling equipment in accordance with Section 5.16 of this plan.

### 5.13 Chemical Analysis

Parameters for testing (i.e., analytical requirements) are outlined in Table 5-1 and are detailed below for each specific site. QC samples are detailed in Section 6, Quality Assurance Plan.

**Table 5-1  
Analytical Requirements**

Constituents	Method of Analysis
40 CFR 264 Appendix IX Metals	SW-846 Methods 6010/7000 Series
Volatiles and Semi-volatiles	SW-846 Methods 8240/624; 8270/625
Trinitrotoluene (TNT)	USATHAMA 3S UW14
Cyclotrimethylenetrinitramine (RDX)	USATHAMA 3S UW14
Cyclotetramethylenetetranitromine (HMX)	USATHAMA 3S UW14
Total Organic Carbon (TOC) (water samples)	SW-846 Method 9060
Total Organic Carbon (TOC)	Robert S. Kerr Laboratory SOP for TOC or other appropriate method.
Total Organic Halogen (TOH)	SW-846 Method 9020

**Note:**

USATHAMA = U.S. Army Toxic and Hazardous Materials Agency

All soil and water samples from Chicamuxen Creek's Edge Dump Site B and the Air Blast Pond will be analyzed for the following 40 CFR 264 Appendix IX constituents:

- Metals
- VOCs and SVOCs
- TNT
- RDX
- HMX

All soil and water samples from Rum Point Landfill will be analyzed for the following 40 CFR 264 Appendix IX constituents:

- Metals
- VOCs and SVOCs

#### **5.14 Transporting and Shipping of Samples**

Pack all samples for shipment to avoid breakage and to prevent cross-contamination. Any samples that are considered to contain hazardous materials will be shipped in accordance to the regulations contained in Title 49 CFR.

##### **Sample Packaging Procedures:**

1. Select a cooler in good repair. Seal the drain plug on the inside and outside of the cooler with tape to prevent leakage.
2. Ensure that cooler is clean and of sufficient quality for shipping purposes.



**While Packaging Samples:**

3. Place one sample container in a resealable plastic bag. Three VOC vials may be bagged together.
4. To prevent breakage, *either*:
  - Wrap samples in bubble wrap or other suitable packing material. Seal the protective wrap around the containers with tape. Protective wrap is not required for plastic containers, but take care when packing the coolers so that the containers do not directly touch each other.
  - or*
  - Place 2 to 4 inches of inert packing material on the bottom of the cooler. Place the bagged containers inside the cooler so the bottles do not touch each other. Place cooling material (e.g., double-bagged ice, blue ice) around and in between the samples. Completely fill any remaining space with inert packing material such as vermiculite or cellulose insulation.
5. Include a temperature blank or temperature strip in each sample cooler.
6. Fasten the top of the cooler's large plastic bag with tape.
7. Place double-bagged ice inside the cooler to chill the samples to 4°C ( $\pm 2^\circ\text{C}$ ).
8. Place a chain-of-custody record describing the contents of each cooler in a plastic bag and seal it inside each cooler.
9. Seal the cooler with tape and custody seals so that it cannot be opened without breaking the seal.

**Labeling the Package**

10. Clearly print the words "This End Up" or "This Side Up" on the top of the outer cooler. Place upward pointing arrows on the sides of the package.

11. Mark the cooler with the addresses of the shipper and receiver.
12. If more than one cooler is to be shipped, mark the coolers with the sequential number of the cooler and the total number of coolers (e.g., 1 of 3, 2 of 3, and 3 of 3).

### **5.15 Aquifer Characterization**

Aquifer characterization will be accomplished by conducting specific capacity tests or slug tests. The procedures for each test method are discussed below.

#### **Specific Capacity Tests**

Specific capacity tests will be conducted after the well sampling has been completed or during purging. If the wells do not sustain pumping rates of at least 0.5 gpm without excessive drawdowns, then slug tests will be conducted.

Specific capacity tests are used to determine a well's potential yield and to estimate hydraulic conductivity. These tests involve pumping a well at a constant rate and measuring the drawdown when the water level stabilizes. Specific capacity tests are advantageous because automatic data logging equipment is not necessary. Moreover, these tests "stress" a larger portion of the aquifer near the well, making them preferable to slug tests.

During specific capacity tests, water level measurements will be collected by hand using an electronic water-level indicator. An electric submersible or peristaltic pump will be used to pump the wells. Aquifer parameters will be calculated from the specific capacity test data using a computer program such as that developed by Bradbury and Rothschild (1985) based on equations presented in Lohman (1972).

Drawdown in the well being purged and the duration of pumping will be entered into the computer program with other variables that characterize the aquifer and the pumping system

(storage, well-loss coefficients, pumping rate, and well dimensions). The program output will estimate specific capacity, transmissivity, and hydraulic conductivity.

### **Specific Capacity Test Procedures**

1. Place plastic sheeting around the well. Arrange needed equipment on the plastic sheeting.
2. Don personal protective clothing, as required.
3. Open the locking cap and inspect the wellhead. Allow sufficient time for the water level to equilibrate.
4. Measure the static water level with a decontaminated electronic water level indicator. Record the water level in the appropriate field log book. If appropriate, also measure and record static water levels in adjacent wells.
5. Install a decontaminated pump in the monitoring well. Allow water level to re-equilibrate.
6. Begin pumping at a constant rate.
7. Use the electronic water level indicator to measure changes in the water level during pumping. Record water levels and time of collection at the regular intervals in the field log book.
8. Continue pumping and recording the water levels until the level stabilizes or until purging is complete. If appropriate, measure and record the water levels in the surrounding monitoring wells or temporary piezometers installed near the pumping well.
9. Record the time of test completion and the final water level in the appropriate field log book. Turn the pump off.

10. Record the recovery of the water level(s) in the pumping well and, where appropriate, observation wells, using a water level indicator and a stopwatch.
11. The specific capacity data will be used to estimate K using equations provided in Lohman (1972).
12. Decontaminate all equipment in accordance with Section 5.16.
13. Close and lock the monitoring well upon completion of the aquifer test.
14. Place all disposable items (e.g., plastic sheeting, personal protective equipment) and investigation derived wastes in a designated drum for future disposal by the Navy.

#### **Slug Testing**

If specific capacity tests are not conducted, rising- and falling-head slug tests will be performed to estimate hydraulic conductivity. Although slug tests require more equipment and time to implement than specific capacity tests, slug tests do not require pumping and are therefore applicable in low yield formations. More importantly, little or no contaminated water is produced thereby eliminating the need for containment and disposal.

Falling-head slug tests involve "instantaneously" introducing a slug into a well, while the water level and the time ( $T_0$ ) are recorded. Periodically, water level/elapsed-time measurements are recorded as the water level falls back to the original static level. Similarly, rising-head slug tests are performed by removing the slug and recording water level/elapsed-time measurements as the water level returns to static level. The time required for each slug test is a function of the water level rate of change and the aquifer's hydraulic conductivity.

For each slug test, a pressure transducer and automatic data logger will be used to measure and record well water levels. To facilitate data graphing, the loggers will be programmed to record measurements on a logarithmic time scale.

The slug will be a sealed Teflon or stainless-steel cylinder of known volume, 1- to 8-feet long, attached to a Teflon-coated stainless-steel cable or nylon rope. The slug will be suspended in the well just above or below the water level. At the beginning of each test, the data logger will be activated the instant the slug is either lowered into or removed from the water.

Raw data from the loggers will be downloaded to a computer for data reduction and manipulation. Data will be compiled using a computer program such as Aquifer Test Solver (AQTESOLV) by the Geraghty and Miller Modeling Group (1989). AQTESOLV estimates hydraulic conductivity and transmissivity from slug test data.

#### **General Procedures for Performing a Slug Test**

1. Insert a decontaminated pressure transducer, calibrated to an electronic data logger, to an appropriate depth in the well to be tested.
2. Add (or remove) a known volume to (or from) the well or piezometer to create a rapid rise (or fall) in water level. In most cases, a decontaminated stainless-steel or Teflon cylinder will be used.
3. Measure the rate of water-level recovery using the pressure transducer and data logger.
4. Graph data as depth-time pairs, and determine hydraulic conductivity and aquifer transmissivity using commercially available aquifer analysis software.

## **Procedures for Falling-Head Slug Test**

### **Before Slug Testing:**

1. Place plastic sheeting around the wellhead. Arrange needed equipment and decontaminated materials on the sheet.
2. Put on personnel protective clothing, as required.
3. Open the locking caps and inspect the wellhead. Note in particular the condition of the surveyed reference mark, if any.
4. After water levels have stabilized, measure and record the static water level and the depth to the bottom of the well. Record these data in the appropriate logbook.

### **During Slug Testing:**

5. Check the calibration of the pressure transducer at two different depths in the well. Check depths should be as widely separated as possible. Leave the transducer at the lower check point and zero the data logger.
6. Rapidly insert the decontaminated slug (stainless-steel or Teflon cylinder) into the water.
7. Using the data recorder, record fall in water level versus time. (A data logger such as an In-Situ, Inc. Hermit Data logger® or equivalent will be used.)
8. Continue recording depth-time data until the well has recovered to the static water level. When using data recorders, it is advisable to check and record the reading every few minutes to ensure that data are being properly recorded.

### **After Slug Testing:**

9. Record the time of test completion in the logbook. If a data recorder with random access memory (RAM) or erasable programmable read only memory (EPROM) was used, record the file name used.

10. Decontaminate all equipment according to Section 5.16. Clean up the site, and close and lock the well before leaving. Discard contaminated plastic sheeting and disposable protective clothing in a clearly marked drum.

**Note:** Both rising- and falling-head slug tests may be carried out in the same operation by first measuring the rate of water level fall immediately after slug insertion, then measuring the rate of water level rise after slug withdrawal. Be sure that the well has equilibrated before conducting the rising-head test. Additionally, rising-head tests are more accurate than falling-head tests in wells that have static water levels within the screened interval.

### **Procedures for Rising-Head Slug Test**

#### **Before Slug Testing:**

1. Lower a decontaminated slug (stainless-steel or Teflon cylinder) of known volume into the well until it is fully submerged. Allow the well to re-equilibrate to static water level.
2. Turn on the data recorder, if used, or verify that static water level has been re-established with a water level meter.

#### **During Slug Testing:**

3. Withdraw the slug quickly, but avoid surging.
4. Using a data logger, record the rise in water level versus time.
5. Continue recording water-level/time data until the well has recovered to nearly the static water level. When using data recorders, it is advisable to check and record readings every few minutes to ensure that data are being properly recorded.
6. Record the time of test completion in the field logbook. If a data recorder with RAM or EPROM memory was used, record the file name used.

**After Slug Testing:**

7. Decontaminate all equipment. Clean up the site, and close and lock the well before leaving. Place any contaminated plastic sheeting and disposable protective clothing in a clearly marked drum for future disposal by the Navy.

**Restriction/Limitations**

In wells in which the static water level and water levels induced during testing are above the top of the screened or open hole interval, both rising-head and falling-head tests should be conducted to provide a check of results.

**Quality Control Requirements for Slug Tests**

- A pressure transducer and data logger, or strip chart recorder, must be used to perform these tests.
- Slug tests shall be performed after groundwater sampling to minimize contamination.
- All equipment must be decontaminated before each test.
- If possible, both falling and rising-head tests shall be performed.
- In the event that a data logger ceases to function during a test, the data logger will be repaired or replaced and the test will be repeated.

**5.16 Decontamination Procedures**

To prevent cross-contamination during well boring and sampling, all equipment (sampling, drilling, mobilization, etc.) that is used during the investigation will be decontaminated. All decontamination procedures will take place in a contained area which will be constructed before the investigation begins. All wastewater collected in the containment basin will be pumped into 55-gallon drums and maintained onsite for proper disposal with other wastes from the investigation.



Decontamination procedures will be performed as discussed below. The detergent for use on this project will be Liquinox. When available, hot tap water will be used for field decontamination. PVC well construction materials will not be rinsed with solvent or washed with hot water. Final equipment rinse water will be deionized, filtered, and organic-free water. The steam cleaner and/or high-pressure hot water washer will be capable of generating adequate pressure and producing hot water and/or steam.

#### **5.16.1 Setting Up a Decontamination Area**

Cleaning and decontamination will occur at a designated area generally onsite but downgradient and downwind from the clean equipment storage area. The decontamination area will be lined with heavy-duty plastic sheeting and will be designed to promote surface runoff into a catch basin or pit. If a pit cannot be excavated, a catch basin will be constructed of wood and lined with plastic to contain the waste/rinse water until it can be containerized into 55-gallon drums. All equipment will be cleaned on sawhorses or auger racks above the plastic sheeting. Upon completion of the drilling activities and removal of all waste/rinse water from the pit, the pit shall be backfilled with clean material. The Navy will be responsible for the disposal of all decontamination wastes once they have been characterized by the engineering subcontractor.

#### **5.16.2 Preventing Cross-Contamination**

Follow the procedures below to reduce the risk of cross-contamination during decontamination.

1. Don a new pair of disposable outer gloves before handling sampling equipment during decontamination.
2. Use only Teflon, glass, or stainless-steel spray bottles/pressurized containers to apply decontamination rinsates. Keep each solution in a container designated and labeled specifically for that solution.

3. Decontaminate the appropriate amount of field equipment for each task to minimize the need for field cleaning.

#### **5.16.3 Drill Rig Decontamination**

The drill rig will be decontaminated before initiating drilling activities. It will also be decontaminated between each investigation site. The following lists the decontamination procedures for the drill rig(s).

1. Decontaminate with high-pressure wash.
2. If necessary, scrub with a laboratory-grade detergent and clean water wash solution.
3. Rinse with clean water as necessary.

#### **5.16.4 Sampling Equipment**

Sampling equipment includes any downhole equipment (e.g., augers, drill pipe, stainless-steel split barrel samplers, Teflon-coated hand augers, bailers, etc.) and any sampling utensils (e.g., stainless-steel spoons, spatulas, and bowls, etc.), that are not dedicated to the sample location. Downhole equipment that is hollow or has holes that transmit water or drilling fluids will be cleaned on the inside and outside.

1. Don protective gloves prior to decontaminating the equipment.
2. Wash and scrub with a laboratory-grade detergent and clean water wash solution, or decontaminate with high pressure steam.
3. Rinse with clean water.
4. Rinse with deionized, organic-free water.
5. Rinse with pesticide-grade isopropanol.

6. Rinse with deionized, organic-free water.
7. Air dry.
8. Wrap hand operated and other small sampling equipment in aluminum foil if the sampling equipment is to be stored or transported.
9. Augers and drill rods will be placed and covered in clean plastic after decontamination.

Each rinsing solution will be kept in a bucket designated specifically for that solution. When each solution is changed, each waste material will be poured into a 55-gallon drum marked specifically for that waste. When each drum has been filled, a sample will be collected and sent to a Naval Facilities Engineering Service Center (NFESC)-approved laboratory for analysis to determine if the water is contaminated. If the water is contaminated, it will be maintained onsite and disposed of properly with the other IDW. If the water is not contaminated, it will be poured onto the ground at the site, or into the sewer system, if permitted.

#### **5.16.5 Personal Decontamination**

Personal decontamination procedures are outlined in the HASP.

#### **5.17 Investigation Derived Waste**

All sampling spoils, development water, purge water, decontamination fluid, and disposable equipment will be containerized in 55-gallon drums and maintained onsite for proper disposal. All drums will be labeled with the site and boring/well number from where the waste was generated; type of waste, date of generation, and project number will be written on the drum. The drums will be labeled with a waterproof grease pencil or paint pen. All wastes will be sampled to determine proper disposal following the investigation. All disposal will be conducted in accordance with all applicable federal and state provisions and regulations.

## **6.0 QUALITY ASSURANCE PLAN**

This Quality Assurance Plan (QAP) document presents policies, project organization and objectives, functional activities, QA and QC measures intended to achieve data quality goals of the VI to be performed at the NAVEODTECHCEN at Stump Neck Annex, Indian Head, Maryland. This investigation is part of RCRA Corrective Action and Waste Minimization Permit MD417-009-0001 issued, through RCRA, by EPA Region III. The project contract number is N62467-89-D-0318/0004.

This document is intended to fulfill requirements for ensuring that all work will be conducted in accordance with QA/QC protocols, and field procedures for environmental monitoring and measurement data as established in:

- *Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program, NEESA 20.2-047B*, Naval Energy and Environmental Support Activity, Port Hueneme, California, June 1988 (NEESA 20.2-047B)
- *Ground-Water Monitoring Guide, NEESA 20.2-031A*, Naval Energy and Environmental Support Activity, Port Hueneme, California, February 1985 (NEESA 20.2-031A)

Where specific EPA guidelines do not exist, applicable MDE and/or NFESC guidelines and methods will apply. These regulations are referenced in specific sections of this document (where applicable).

### **6.1 Project Description**

The VI will focus on three areas of Stump Neck Annex: Rum Point Landfill, Chicamuxen Creek's Edge Dump Site B, and Air Blast Pond. Investigation activities will provide data required to determine if contamination is present in the soil, subsoil, and/or groundwater systems

associated with these sites. The data will also be used to determine what follow-up action, if any, is required to maintain compliance with environmental regulations.

Advancement of soil borings, some of which will be completed as groundwater monitoring wells, and associated well purging, development, and sampling as required will be performed. All boring/well installations and associated fieldwork are described in this document.

### **Logistics**

All subcontractors hired to implement the VI will be familiar with the contents of the associated field plans, including the HASP. All work will be completed in accordance with the approved plans. Field mobilization will occur within 90 days of EPA Region III approval and funding approval by the Navy.

A temporary work space will be established at the Stump Neck Annex for equipment storage (including health and safety) and sample processing.

## **6.2 Project Quality Assurance Objectives**

In general, QA objectives are to assess and document the precision, accuracy, representativeness, completeness, and comparability of all sampling and analysis performed. Quality criteria are set to ensure the data obtained during projects are suitable for the intended use, and to meet goals established by NFESC. The following discusses the project QA and data quality criteria.

### **6.2.1 Field Measurements**

QA objectives for parameters to be measured in the field by sampling personnel are presented in Table 6-1. Field measurements will include pH, temperature, specific conductance, turbidity, and static groundwater level.

**Table 6-1**  
**Field Measurements**

Measurements Parameter	Reference	Matrix	Precision (%)	Accuracy % Recovery	Completeness
pH	EPA 150.1 <sup>a</sup>	Water	± 0.05 pH	± 0.2 pH	100
Temperature	EPA 170.1 <sup>a</sup>	Water	± 0.1°C	± 0.2°C	100
Static Water Level	SOP <sup>b</sup>	Water	± 0.01 in.	± 0.005 in.	100
Photoionization Detector	SOP <sup>c</sup>	Air	± 10 ppm	± 20 ppm	100
Well Survey Points	SOP <sup>d</sup>	Spatial	± 5%	± 0.1 feet	100
	SOP <sup>d</sup>	Vertical	± 0.05 feet	± 0.01 feet	100

**Notes:**

- <sup>a</sup> = Methods for Chemical Analysis of Water and Wastes, EPA-600/4/79-020, Revised March 1983.
- <sup>b</sup> = Manufacturer's SOP for static water level measurement.
- <sup>c</sup> = Manufacturer's SOP for operation of Photovac TIP II or HNu.
- <sup>d</sup> = Standard Land Surveying Methods as employed by registered land surveyors.

### 6.2.2 Sampling and Analysis for Contamination Level

Project QA objectives of analytical parameters for soil and groundwater are stipulated in EPA Method 8270/625, 8240/6240, 6010, U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) UW14, and as determined by the analytical laboratories historical data quality evaluation for these methods. The NFESC laboratory approval process ensures that laboratory method QA/QC standards are appropriate to meet goals for intended data uses. Anticipated QA goals for these methods are presented in Table 6-2. Table 6-3 indicates QA goals for USATHAMA methods.

### 6.2.3 Precision and Accuracy

Methods of assessing precision and accuracy of investigations are discussed in Section 6.8. The precision and accuracy parameters for this investigation are included in Tables 6-3 and 6-4.

**Table 6-2**  
**Contract Laboratory Program Target Compound List Quality Objectives**  
**Matrix Spikes/Matrix Spike Duplicates/Surrogate Spikes**

Fraction	Compound	Soil Precision (%RPD)	Soil Accuracy (%Recovery)	Water Precision (%RPD)	Water Accuracy (%Recovery)
<b>VOA (8240/624)</b>	<b>Matrix Spikes</b>				
	1,1-Dichloroethene	22	59-172	14	61-145
	Trichloroethene	24	62-137	14	71-120
	Chlorobenzene	21	60-133	13	75-130
	Toluene	21	59-139	13	76-125
	Benzene	21	66-142	11	76-127
<b>VOA</b>	<b>Surrogate Spikes</b>				
	Toluene-d <sub>8</sub>	—	81-117	—	88-110
	4-Bromofluorobenzene	—	74-121	—	86-115
	1,2-Dichloroethane-d <sub>4</sub>	—	70-121	—	76-114
<b>BNA (8270/625)</b>	<b>Matrix Spikes</b>				
<b>BN</b>	1,2,4-Trichlorobenzene	23	38-107	28	39-98
	Acenaphthene	19	31-137	31	46-118
	2,4-Dinitrotoluene	47	28-89	38	24-96
	Di-n-butyl Phthalate	47	29-135	40	11-117
	Pyrene	36	35-142	31	26-127
	N-Nitroso-Di-n-Propylamine	36	41-126	38	41-116
	1,4-Dichlorobenzene	27	26-104	26	36-97
<b>A</b>	Pentachlorophenol	47	17-109	50	9-103
	Phenol	35	26-90	42	12-89
	2-Chlorophenol	50	25-102	40	27-123
	4-Chloro-3-Methylphenol	33	26-103	42	23-97
	4-Nitrophenol	50	11-114	50	10-80
<b>BNA</b>	<b>Surrogate Spikes</b>				
	Nitrobenzene-d <sub>5</sub>	—	23-120	—	35-114
	2-Fluorobiphenyl	—	30-115	—	43-116
	p-Terphenyl-d <sub>14</sub>	—	18-137	—	33-141
	Phenol-d <sub>5</sub>	—	24-113	—	10-94
	2-Fluorophenol	—	25-121	—	21-100
	2,4,6-Tribromophenol	—	19-122	—	10-123

**Notes:**

VOA = Volatile Organics  
BN = Base/Neutral Extractable  
A = Acid Extractable  
- = Advisory Limits

**Table 6-3**  
**USATHAMA Method UW14 Precision and Accuracy**

Measurement Parameter	Reference	Matrix	Precision (%)	Accuracy (% recovery)	Completeness
Explosives and related materials	USATHAMA UW14 with EPA3040 Extraction	Soil	50%	25-125%	100%
Explosives and related materials	USATHAMA UW14	Water	40%	25-120%	100%

**Table 6-4**  
**Contract Laboratory Program Target Analyte List QA Objectives**  
**Matrix Spikes/Duplicate Analyses**

Compound (Metal)	Medium/High Sample Precision <sup>a</sup> (%RPD)	Low Sample Precision <sup>b</sup> (%RPD)	Accuracy (% Spike Recovery)
Antimony	± 20	± CRDL	75-125
Arsenic	± 20	± CRDL	75-125
Barium	± 20	± CRDL	75-125
Beryllium	± 20	± CRDL	75-125
Cadmium	± 20	± CRDL	75-125
Chromium	± 20	± CRDL	75-125
Cobalt	± 20	± CRDL	75-125
Copper	± 20	± CRDL	75-125
Lead	± 20	± CRDL	75-125
Mercury	± 20	± CRDL	75-125
Nickel	± 20	± CRDL	75-125
Selenium	± 20	± CRDL	75-125
Silver	± 20	± CRDL	75-125
Thallium	± 20	± CRDL	75-125
Tin	± 20	± CRDL	75-125
Vanadium	± 20	± CRDL	75-125
Zinc	± 20	± CRDL	75-125
Cyanide	± 20	± CRDL	75-125

**Notes:**

- <sup>a</sup> = Medium/High Samples = Compound or metal present at 5 times (or more) the Contract Required Detection Limit (CRDL).
- <sup>b</sup> = Low Samples = Compound or metal present at less than 5 times the CRDL.

QA/QC Requirements excerpted from 2/88 CLP statement of work.



#### **6.2.4 Representativeness**

The goal of this investigation is to assess the nature and extent of possible soil and groundwater contamination caused by ordnance disposal and related hazardous waste at the site. By properly collecting soil and groundwater samples, and measuring well parameters in accordance with NFESC (and others by reference) protocol and EPA SOP/QAM, samples collected during the investigations will be representative of areas of concern.

#### **6.2.5 Completeness**

Completeness goals of field measurements reflect the ability to resample all existing and planned wells, and subsequent sample collection for groundwater quality criteria defined in the QAP.

#### **6.2.6 Comparability**

Comparability is ensured through the use (by field technicians and the laboratory) of established methods of sampling and analysis as specified in NEESA 20.2-031A and NEESA 20.2-047B, as well as other accepted methods.

### **6.3 Project Organization and Responsibilities**

Overall responsibility for projects conducted in accordance with NFESC regulations will be vested in NFESC (or its approved representatives). Therefore, project coordination responsibilities lie with the Chesapeake Division, Naval Facilities Engineering Command. The following describes the components of the project chain-of-command as established in NEESA 20.2-047B.

#### **6.3.1 Oversight**

##### **6.3.1.1 Navy Facilities Engineering Service Center**

NFESC is responsible for ensuring that the quality of laboratory analyses performed during the various phases of Comprehensive Long-Term Environmental Action Navy (CLEAN) is

acceptable and that this project has appropriate overall QA. NFESC will review any laboratory QA plans submitted, and answer questions for subcontractors and the Engineer-in-charge (EIC) regarding specific field and laboratory QC practices. NFESC will ensure the laboratory is following Navy Installation Restoration (IR) QA/QC procedures.

#### **6.3.1.2 Engineering Field Division**

The EIC at the Engineering Field Division (EFD) provides the available site information and history, provides logistical assistance, specifies the sites requiring investigation and reviews results and recommendations.

The EIC is responsible for coordinating procurement, finance, and reporting; for ensuring that any necessary documents are reviewed by NFESC; for communicating comments from the NFESC and other technical reviewers to the subcontractors; and for ensuring that the subcontractors address all the comments submitted and take appropriate corrective actions.

#### **6.3.1.3 State or Local Oversight**

The MDE will serve as oversight for this investigation. The results of the soil and groundwater sampling program will be forwarded to the MDE to comply with division requirements (for environmental assessments). The investigation results will be presented in the form of a Contamination Assessment Report (CAR). The VI has been requested in accordance with requirements set forth in EPA Permit for Corrective Action and Waste Minimization (Permit MD 417-009-0001), Part II, A, paragraph 3, under RCRA as amended by HSWA 1984.

### **6.3.2 Investigation Performance**

#### **6.3.2.1 Engineering Subcontractor**

The Engineering Subcontractor is responsible for designing and implementing the field investigation activities.

#### **6.3.2.2 Analytical Laboratory**

The analytical laboratory employed by the Engineering Subcontractor must adhere to the laboratory requirements in NEESA 20.2-047B (or other QA and method requirements as specified). The laboratory is required to prepare and submit a laboratory QA plan, to analyze and submit the results of proficiency testing, to submit to an onsite inspection, and to correct any deficiencies cited during the inspection by the NFESC. The laboratory is required to identify a Laboratory QA Coordinator (LQAC) responsible for overall QA. The LQAC must not be responsible for schedule, costs, or personnel other than QA assistants. It is preferred that the LQAC report to the laboratory director. The LQAC must have the authority to stop work on projects if QC problems arise which affect the quality of the data produced.

In addition to conforming to all NFESC regulations, all work shall be performed in a manner consistent with: RCRA, as amended; the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300, as amended; and other appropriate federal, state, and local guidelines, rules, regulations, and criteria (where applicable).

#### **6.3.3 Soil and Sediment Sample Analyses**

All soil samples analyses will be performed in accordance with NEESA 20.2-047B, Chapter 7 — Analytical Methods. NFESC has established that all soil samples will be analyzed by EPA Methods 8240 and 8270 volatiles and semivolatiles, and EPA Method 6010/7000 (Metals) and USATHAMA Method UW14 (Explosives).

#### **6.3.4 Soil Sample Documentation**

All soil samples will be documented in accordance with NEESA 20.2-031A, Chapter 6 — Monitoring Well Data Record Requirements. Engineering subcontractor personnel will use bound logbooks to maintain all field records pertaining to the investigation. These records will document all visual observations, calculations, and equipment calibrations. Each entry will be dated and the time noted. The logbooks are accountable documents that will be properly maintained and retained as part of the project files. In addition, soil boring logs will be

produced for all soil borings advanced onsite. Information to be included on boring logs includes: total depth of boring, lithologic descriptions of each geologic formation encountered, blow counts for split-spoon-sampler penetration, water-bearing zones, and any subsurface obstructions encountered during boring advancement (with explanations if available).

#### **6.3.5 Groundwater Sample Analysis**

All groundwater samples analyses will be performed in accordance with NEESA 20.2-047B, Chapter 7 — Analytical Methods. All groundwater samples will be analyzed for metals, VOCs, SVOCs, TNT, RDX, and HMX. Temperature, pH, conductivity, and turbidity will also be measured in the field for each sample collected.

#### **6.3.6 Groundwater Sample Documentation**

All groundwater samples will be documented in accordance with NEESA 20.2-047B, Chapter 3 — Site-Specific QC Requirements, and NEESA 20.2-031A, Chapter 6 — Monitoring Well Data Record Requirements. Engineering Subcontractor personnel will use bound logbooks to maintain all field records for the investigation. These records will document all visual observations, calculations, and equipment calibrations. The logbooks are accountable documents that will be properly maintained and retained as part of the project files.

#### **6.4 Sample Identification, Containers, Preservation, and Labeling**

Pre-cleaned sample containers will be provided by the laboratory. The engineering subcontractor will receive the containers from an approved laboratory that has followed NEESA 20.2-047B, Chapter 3.5 — Sample Container Cleaning Procedures (and/or other applicable protocol), and the containers will remain in the custody of the engineering subcontractor personnel. Each sample container will be affixed with a label which shall include site and sample designation, sampling time and date, sample preservation, sampler identification, and analytical methods. Figure 14 is an example of the sample container label. Table 6-5 provides information regarding sample containers, preservation methods, and holding times on an analytical method- and matrix-specific basis.

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SITE NAME	DATE
ANALYSIS	TIME
	PRESERVATIVE
SAMPLE IDENTIFICATION	
PROJECT NUMBER	



VERIFICATION INVESTIGATION  
STUMP NECK ANNEX  
INDIAN HEAD, MARYLAND

FIGURE 14  
EXAMPLE SAMPLE LABEL

DWG DATE: 09/14/95

DWG NAME: 4VISL

**Table 6-5**  
**Sample Containers, Preservation, and Holding Times**

Analytical Method	Sample Matrix	Container Size/Material	Sample Preservation	Holding Time
EPA Method 8270	Soil	8 oz. Clear glass, wide-mouth jar w/Teflon-lined lid	4°C, store in dark	14 days to extraction, 40 days to analysis
EPA Method 625	Water	2.5 Liter amber glass jar w/Teflon lined-lid	4°C, store in .008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>	7 days to extraction, 40 days to analysis
EPA Method 6010 or (7000 Series)*	Soil	16 oz. Boston round glass jar w/Teflon-lined lid	4°C	up to 6 mos. until analysis
EPA Method 6010 or (200 Series)*	Water	1 Liter HDPE Bottle	4°C, pH < 2 with HNO <sub>3</sub>	up to 6 mos. until analysis
EPA Method 7196 (Chromium VI)	Soil	8 oz. clear Glass, wide-mouth jar w/Teflon-lined lid	4°C	24 hours to analysis
EPA Method 218.4 (Chromium VI)	Water	250 ml. HDPE Bottle	4°C	24 hours to analysis
EPA Method 7470 (Mercury)	Soil	8 oz. clear glass, wide-mouth jar w/Teflon-lined lid	4°C	28 days to analysis
EPA Method 245.1 (Mercury)	Water	250 ml. HDPE Bottle	4°C, pH < 2 with HNO <sub>3</sub>	28 days to analysis
EPA Method 8240	Soil	4 oz. clear glass, wide-mouth jar w/Teflon-lined lid	4°C	14 days to analysis
EPA Method 624	Water	2 x 40 ml vials w/Teflon-lined septa	4°C	14 days to analysis
USATHAMA Method UW14 (Explosives) with EPA Method 3040A Extraction	Soil	8 oz. clear glass, wide-mouth jar w/Teflon-lined lid	4°C, store in dark	14 days to extraction, 40 days to analysis
USATHAMA Method UW14 (Explosives)	Water	1 liter amber glass jar w/Teflon-lined lid	4°C, store in dark	14 days to extraction, 40 days to analysis
EPA Method 9020 (TOX)	Soil	4 oz. clear glass, wide-mouth jar w/Teflon-lined lid	4°C, store in dark	7 days to extraction, 40 days to analysis
EPA Method 9020 (TOX)	Water	16 L Boston round jar	4°C, pH < 2 with H <sub>2</sub> SO <sub>4</sub>	7 days to extraction, 40 days to analysis
Robert S. Kerr Lab SOP for TOC or EPA Method 9060	Soil	4 oz. clear glass, wide-mouth jar w/Teflon-lined lid	4°C	28 Days
EPA Method 415.1	Water	125 ml HDPE	4°C pH < 2 with HCL	28 Days
EPA Method 150.1	Water	60 ml HDPE	4°C	Immediately

**Notes:**

- \* = In order to obtain the lowest Practical Quantitation Limit for each metal, various instrumental methods will be required. For Appendix IX metals, the following methods provide optimal PQL's:  
 ICAP — Barium, Cobalt, Copper, Nickel, Silver, Zinc  
 Graphite Furnace AA — Antimony, Beryllium, Cadmium, Chromium, Lead, Selenium, Thallium, Vanadium  
 Flame AA — Arsenic, Tin  
 Cold Vapor AA — Mercury  
 HDPE = high-density polyethylene

#### **6.4.1 Sample Identification**

All samples will be identified and fully documented in the field records, on the chain-of-custody records, and on the sample labels. Any samples that are thought to be potentially hazardous (i.e., corrosive, flammable, etc.) will be identified as such in the field records and on the chain-of-custody records.

All samples will be identified using the following labeling system:

FORMAT: XXXX/1234567890

XXXX/	—	OPTIONAL project prefix
123	—	SITE where sample was collected
4	—	MATRIX/QC code
5678	—	SAMPLING LOCATION
90	—	DEPTH, INTERVAL, SERIAL NUMBER

#### **MATRIX/QC CODES:**

S — Soil (surface, borings, and trenches)  
C — Soil duplicate sample  
M — Sediment (settled, fluid-borne solid)  
N — Sediment duplicate  
G — Groundwater  
H — Groundwater duplicate  
W — Surface water  
R — Surface water duplicate sample  
U — Sludge  
Y — Sludge duplicate  
A — Air  
Z — Liquid waste (including IDW drums)  
V — Solid waste (including IDW drums)

T — Trip blank  
E — Equipment rinsate blank  
D — DI system blank  
P — Potable water blank  
F — Field blank  
L — Filter blank  
B — EPA blind spike sample  
2 — Cement blank  
3 — Drilling mud  
4 — Grout blank  
5 — Bentonite blank  
6 — Sand blank

#### **6.4.2 Sample Preservation**

Some of the analyses require that the samples be preserved immediately upon collection in the field in order to maintain their integrity. Each sample preserved with chemicals will be clearly identified by indicating on the sample label that the sample is preserved. Specific sample preservations for each analysis are detailed in Table 6-5. Soil samples will be preserved by chilling at 4°C before and during shipment.

#### **6.4.3 Sample Handling**

After collection, samples will be handled as infrequently as possible. Extreme care will be taken to ensure that samples are not contaminated. Resealable plastic bags will be used to protect any samples placed in coolers filled with bagged ice. This precaution is taken to ensure that melted ice will not cause the containers to be submerged, which may cause cross-contamination.

To further reduce risk of cross-contamination, containers for samples known to contain high concentrations of contaminants will be kept separately from those samples containing trace amounts of contaminants. A trip blank, prepared in the laboratory and shipped with the sample containers, will be kept and shipped with each set of samples and analyzed for volatiles.

#### **6.4.4 Collection of Auxiliary Data**

All auxiliary data relative to a particular sampling location will be collected as close to the sample collection time as possible. Auxiliary data will include field measurements such as pH, conductivity, temperature, etc. Sampling events will be photographed in order to keep records of all activities. The field records will include all information about weather and other activities that occur during the sampling events, as well as the times that any events occur. Boring logs will be maintained for all boreholes. Pumping rates and water level measurements involved in the sampling of the monitoring wells will be recorded where applicable.



#### **6.4.5 Chain-of-Custody**

The engineering subcontractor will follow strict chain-of-custody procedures in accordance with NEESA 20.2-047B, Chapter 3.8. The engineering subcontractor will use chain-of-custody forms, such as illustrated in Figure 15 for transferring sample shipments to the laboratory. All samples will also be documented in a project field logbook.

Upon transfer of custody, the chain-of-custody form will be signed by the field sampling team leader, including the date and time the samples were relinquished. As common carriers will not sign chain-of-custody forms, these records will be sealed within each shipping container. All chain-of-custody forms received by the laboratory must be signed and dated by the laboratory sample custodian and returned to engineering subcontractor following receipt, or as part of the data reporting package.

#### **6.5 Calibration Procedures and Frequency**

The analytical laboratory will calibrate analytical instruments in accordance with NEESA 20.2-47B (and specific instrument methods by reference). Adherence to proper calibration procedures will be determined by the NFESC Contract Representative (NCR) during the onsite laboratory inspection.

The engineering subcontractor plans to calibrate field equipment such as pH, temperature, specific conductance, and PID according to manufacturer's standard operating procedures (SPOs). Field equipment for which SOPs are not in force will be calibrated and operated in accordance with the manufacturer's recommendations.

#### **6.6 Analytical Procedures**

This investigation will use the following analytical procedures.



NAVY CLEAN

## CHAIN OF CUSTODY RECORD

PAGE \_\_\_\_\_ OF \_\_\_\_\_

CLIENT \_\_\_\_\_ PROJECT MANAGER \_\_\_\_\_  
ADDRESS \_\_\_\_\_ TELEPHONE NO. \_\_\_\_\_  
PROJECT NAME/NUMBER \_\_\_\_\_ FAX. NO. \_\_\_\_\_  
MEDIA STATUS: (A, B, OR C) \_\_\_\_\_ SAMPLERS: (SIGNATURE) \_\_\_\_\_

[illegible]

VERIFICATION INVESTIGATION  
CHANGE TEXT  
STUMP NECK ANNEX  
INDIAN HEAD, MARYLAND

FIGURE 15  
EXAMPLE CHAIN OF CUSTODY

DWG DATE: 09/14/95	DWG NAME: CLNCUST
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#### **6.6.1 Field Analyses**

Soil sample screening will be performed as outlined in Section 5. Static water level will also be measured on all monitoring wells subsequent to well development with adequate time allowed for well recharge.

Monitoring well casing (tops) will be surveyed (spatial and horizontal orientation) by a State of Maryland-registered land surveyor. The survey measurements will be recorded relative to the USGS North American Datum (NAD) '27.

All field measurements will be recorded in a dedicated field logbook and/or appropriate field activity log (i.e., boring log, well construction log, etc.).

#### **6.6.2 Laboratory Analyses**

Selected soil samples collected during the course of this investigation will be analyzed by EPA Methods 8240 and 8270 for volatiles and semivolatiles, EPA Method 6010/7000 for metals, EPA Method 7196 for chromium VI, and EPA Method 7470 for mercury and USATHAMA 3S for Explosives. USATHAMA UW14 does not specifically include an extraction method for dealing with soil/sediment. As a result, a modified Soxhlet method extraction procedure will be used. All water samples collected during this investigation will be analyzed for EPA Methods 624, 625, 6010/7000 and USATHAMA UW14 analysis.

#### **6.7 Data Reduction, Validation, and Reporting**

Laboratory procedures for data reduction, validation, and reporting will be conducted according to SOPs as dictated by the requirements of NEESA 20.2-047B, Chapters 7 — Analytical Methods, and 8 — Maintaining Laboratory Approval. The specific procedures for data reduction, validation and reporting will be those outlined for Level C QC data in NEESA 20.2-047B, and NFESC-approved laboratory QA plan. For USATHAMA Method

UW14, QC procedures specific to this method (as outlined in the method) will be applied. Required internal QC checks and data validation procedures are described in Section 6.8.

The engineering subcontractor's use of the laboratory will be accomplished by a services agreement (contract). The contract will specify the scope of services to be performed by the laboratory, the specific analytical QA requirements to be met, and the information to be developed and reported.

### **6.8 Field and Laboratory QC Checks**

Internal laboratory control checks used by the laboratory will be conducted there by its staff. The engineering subcontractor will conduct internal QC checks of sampling procedures and laboratory analyses. These checks will consist of preparation and submittal of sampler rinsate blanks, trip blanks, field blanks, and field duplicates for analysis, and an evaluation of the laboratory analytical package. The data validation checklists, included as Appendix A, will be used as guides in evaluating data collection, field records, and analytical performance; these checklists will aid in identifying valid data and in classifying the data into one of three use categories: unusable data, Class A (qualitative) data, or Class B (qualitative and quantitative) data.

The required control check samples frequencies are outlined in NEESA 20.2-047B, Chapter 3 — Site-Specific QC Requirements, and Chapter 7 — Analytical Methods. For Level C, QC measures can be discussed for sampling and analysis as follows:

#### **6.8.1 Field Data Quality**

All fieldwork will be conducted and/or supervised by engineering subcontractor personnel to ensure that proper procedures are followed. Field records will be kept of all activities that take place during the investigation and these records will be maintained at the engineering

subcontractor's office with a copy being forwarded to the EIC of the project. These records will include any obstacles that may be encountered during the investigation.

Field samples will be collected per the procedures outlined in Section 5 of this document. Precision will be assessed by evaluating the results of duplicate samples, and accuracy will be assessed by evaluating the analyses of field blanks, trip blanks, and laboratory matrix and surrogate spikes.

A **duplicate** is an identical sample collected from the same location (i.e., well) at the same time under identical conditions. Duplicate samples are analyzed along with the original sample to determine procedure precision and inherent source variability. For this project the field duplicate will be used for preparation of the laboratory matrix spike and matrix spike duplicate samples. Due to the heterogeneity of soils, duplicate soil samples are of limited value in assessing the precision of sampling and analytical methods, and as a result, will not be collected during this investigation.

A **field blank** is a sample container filled with organic-free water in the field and is prepared, preserved, and stored in the same manner as the other field samples. The field blanks are analyzed along with the field samples for the constituents of interest to check for contamination imparted to the samples by the sample containers or other exogenous sources. One field blank per sampling event will be prepared.

**Rinsate (or equipment) blanks** are collected by retaining rinsate from sampling equipment. The equipment is rinsed with organic- and analyte-free deionized water after full decontamination. Rinsate samples are collected in containers of the same type and treatment as the sample containers. One rinsate sample will be collected for each analytical method during each week of the field investigation. The rinsate blank is analyzed along with the field samples

for the constituents of interest to check for contamination imparted to the samples by the sampling equipment, containers, or other exogenous source.

A trip blank is a sample container filled with organic-free water that is transported unopened with the sample bottles. It is opened in the laboratory and analyzed along with the field samples for volatile constituents of interest. Trip blanks for all volatile parameters will be prepared and submitted to the laboratory with sample shipping containers containing VOCs. The collection frequencies for QC sample collection are summarized in Table 6-6.

**Table 6-6**  
**Quality Control Sample Collection Frequencies**

Quality Control Sample	Frequency of Collection
Trip Blank (volatiles only)	One per sample shipping cooler containing VOCs
Rinsate Blank	One per week (for duration of field investigation)
Field Blank	One per sampling event
Duplicates	One per 10 samples
Matrix Spike/Matrix Spike Duplicate	One per 20 water samples (Collect 2 additional containers of sample from the well chosen for matrix spike/matrix spike duplicate analysis for each analytical method)

### 6.8.2 Analytical Data Quality

Analytical data quality is assured through the use of QA/QC guidelines as set forth in NEESA 20.2-047B. The guidelines include analysis and evaluation of matrix spikes.

Matrix spike samples prepared by the laboratory are useful in assessing the accuracy of the analytical method, and can detect matrix effects, in which other sample components interfere with the analysis of the contaminant of concern. The method of measuring analytical accuracy is percent recovery. Analysis of matrix spike duplicates will provide a basis for determining

method precision specific to the matrix under investigation. Precision is measured as relative percent difference (%) between duplicate analyses.

Analytical matrix spikes and matrix spike duplicates will be performed at a rate of one per sample batch (20 samples maximum) per matrix in accordance with NEESA 20.2-047B. For groundwater samples, a random sampling location will be chosen for each set of 10 samples. Additional sample volume will be collected, and it will be stipulated on the sample chain-of-custody that the matrix spike and matrix spike duplicate analysis should be performed.

### **6.8.3 Field Data Package**

The field data package will include all field records and measurements obtained at a site by engineering subcontractor personnel in accordance with NEESA 20.2-047B, Chapter 7.2 — Deliverables and NEESA 20.2-031A, Chapter 6 — Monitoring Well Data Record Requirements. The package, including all field records and measurements obtained at the site by sampling personnel, is validated by the following:

- Review field data in water and soil sampling logs for completeness. Failure in this area may invalidate data for litigation or regulatory purposes.
- Verify that field blanks, sampler rinsate blanks, and trip blanks were properly prepared, identified, and analyzed. Failure in this area may compromise the analytical data package and result in some data being considered qualitative or invalid.
- Check on field analyses for equipment calibration and condition. Failure in this area may result in the field measurements being invalidated.

- Review of chain-of-custody forms for proper completion, signatures of field personnel and the laboratory sample custodian, and dates. Failure in this area may invalidate data for litigation or regulatory purposes.

The field data package will be reviewed by the project QA Officer for completeness and accuracy using the checklist in Appendix A.

#### **6.8.4 Analytical Data Package**

The analytical data package will be validated by the project QA Officer (not before completion of field data validation) prior to submittal to NFESC. The validation steps will be performed by applying the applicable EPA Laboratory Data Validation Functional Guidelines for Evaluating Organics and Inorganics Analyses, Technical Directive Document No. HQ-8410-01, and EPA precision and accuracy statements for the analytical methods employed. NEESA 20.2-047B, Chapter 7.3 guidelines will be applied to all Level C data validation procedures. An Analytical Data Validation Checklist (Appendix A) will be used for this purpose.

The analytical data package validation procedure includes, but is not limited to, review of the following:

- Comparison of the data package to the reporting level requirements designated for the project, to confirm completeness.
- Comparison of sampling dates, sample extraction dates, and analysis dates to check that samples were extracted and/or analyzed within the proper holding times. Failure in this area may render the data unusable.



- Review of analytical methods and required detection limits to verify that they agree with the QAP and the laboratory contract. Failure in this area may render the data unusable.
- Review of field and laboratory blanks will be done to evaluate possible contamination sources. The preparation techniques and frequencies, and the analytical results (if appropriate) will be considered.
- Evaluation of all blanks (rinstate blanks, field blanks, trip blanks, reagent blanks, method blanks, and extraction blanks) must confirm freedom from contamination at the specified detection limit. All blank contaminants must be explained or the data applicable to those blanks labeled suspect and sufficient only for qualitative purposes.

#### **6.8.5 Data Classification**

The data will be classified by the Project Quality Assurance Officer based upon the level of reportables and the result of evaluating the field and analytical data packages. The three possible data classes are:

**Unusable Data:** Data that may not be used for any purpose.

**Class A Data:** Data that meet only the Class A screening criteria contained in Appendix A but not the Level B criteria. This class of data may be used for qualitative purposes only, i.e., to help develop or refine study plans, evaluate different sampling or analytical techniques, or identify gaps in the database. For this investigation, data will be classified Class A if all documentation identified by checklists in Appendix A and the QAP have been properly prepared and are available.

**Class B Data:** Data that meets both the Class A and Class B screening criteria. In addition to qualitative uses, the data submitted also may be used for quantitative purposes such as evaluating

conditions such as risks or potential remedial solutions. For this investigation, data will be classified Class B if all analytical and field QC samples (rinsates, blanks, and spikes) are within acceptable control limits.

As with the laboratory data validation, data are classified based on specifically defined criteria. Samples are evaluated by matrix against the specific class criteria and judged as acceptable, provisional, or unacceptable. The explanation of the judging criteria is as follows:

A - Acceptable: All criteria have been successfully met for all samples.

P - Provisional: Some samples have not fully met the criteria but the information is obtainable.

U - Unacceptable: Criteria have not been met with any samples and are not obtainable. These data may not be classified for use unless sufficient other data criteria have been met and scientific judgment indicate the data may be useful if classified.

N - Not Applicable.

Data will be classified using the Data Classification Summary Checklist (Appendix A). A report of the results of the Data Validation for both previously collected and planned data will be submitted to the Project Manager.

## **6.9 Performance and System Audits**

Audits will be performed before and during the work to evaluate the capability and performance of the entire system of measurement and reporting, i.e. experimental design, sampling (or data collection), analysis, and attendant QC activities.

#### **6.9.1 Field System Audits**

The Site Project Manager is responsible for evaluating the performance of field personnel and general field operations and progress. The Site Project Manager will observe the field operations personnel during each kind of activity such as water level readings and sampling rounds. A formal systems audit of field operations personnel by the corporate QA officer will be performed biannually (for all projects) and a field audit report of each sampling team member will be maintained on file by the engineering subcontractor. Where applicable, these audits will ensure that field operations are being conducted in accordance with NEESA 20.2-031A guidelines.

#### **6.9.2 Laboratory Systems Audit**

Laboratory systems audits test methodology and ensure that systems and operational capability are maintained. They also verify that QC measures are being followed as specified in the laboratory written SOP and QAP. The Systems Audit Checklist used by the EPA Contract Laboratory Program (CLP) forms the procedural basis for conducting these audits.

Laboratory initiated audits will be conducted in accordance with guidelines set forth in NEESA 20.2-047B, and the laboratory QAP as approved by NFESC.

#### **6.9.3 Performance Evaluation Audits**

A performance evaluation (PE) audit is performed to evaluate a laboratory's ability to obtain an accurate and precise answer in the analysis of known check samples by a specific analytical method. Following the analytical data validation described in Section 6.9.4, a PE audit of the laboratory may be conducted by the engineering subcontractor. This audit may be conducted if it is determined that the QA data provided are outside acceptance criteria control limits. PE audits may include a review of all raw data developed by the laboratory and not reported (laboratory nonreportables) and the submission of blind spiked check samples for the analysis of the parameters in question. These check samples may be submitted disguised as field

samples, in which case, the laboratory will not know the purpose of the samples; or the samples may be obvious (known) check samples (EPA or National Bureau of Standards [NBS] traceable).

PE audits also may be conducted by reviewing the laboratory's results from "round-robin" certification testing and/or EPA CLP evaluation samples. An additional component of PE audits includes the review and evaluation of raw data generated from the analysis of PE samples and actual field samples that may be in question.

#### **6.9.4 Regulatory Audits**

It is understood that the engineering subcontractor field personnel and subcontract laboratories also are subject to QA audits by the EPA, MDE, and NFESC. NFESC will conduct laboratory inspections prior to approval for participation in any NFESC project, and will provide performance samples to the laboratory for approval purposes.

#### **6.10 Preventive Maintenance**

The sampling equipment employed by the engineering subcontractor during an investigation that may require preventive maintenance will be checked daily for proper operation at the beginning and end of each day. Any replacements or repairs will be made as needed in accordance with manufacturer's instructions. Equipment or instruments potentially requiring preventive maintenance are listed in Table 6-7.

Records of calibration and maintenance activities for each piece of equipment are contained in logbooks assigned to the equipment. The analytical laboratory's preventive maintenance will be performed in accordance with laboratory SOPs as established in an NFESC-approved QAP.

The following discusses daily preventive maintenance procedures for field groundwater screening equipment to be used during the monitoring project.

**Table 6-7**  
**Field Testing Equipment**

Item	Manufacturer	Model Number	Serial Number	Preventive Maintenance
pH Meter	Fisher	Accumet 956	3218	Manufacturer's Operating Manual
Thermometer	—	Platinum RTD	—	Manufacturer's Operating Manual
Conductivity/ pH/Temperature Meter	YSI	3500	—	Manufacturer's Operating Manual
Photoionization Detector	HNu Photovac	HW-101 TIP-II	— ---	Manufacturer's Operating Manual

### Conductivity Meters

- **Each use:** Meter probes are cleaned before and after each use with distilled/deionized water.

Before and after each use (daily) the instruments are checked with a commercial conductivity standard for proper calibration.

The battery is checked for proper charge.

- **Quarterly:** The instrument is inspected quarterly, even if not used during the quarter.

The inspection consists of a general examination of the electrical system (including batteries) and a calibration check.

Instruments not functioning properly are shipped to the manufacturer for repair and calibration.

## pH Meters

- **Each use:** Before each use (daily), the probe should be checked for cracks in the electrode bulb and complete filling with electrolyte solution.

At the beginning and end of any sampling day, the pH meter must be calibrated using two standard pH buffers.

The battery is checked for proper charge.

Following each use, the probe is rinsed with deionized water. The probe cap is filled with electrolyte solution and placed on the probe tip. Excess electrolyte is rinsed off and the probe dried with a paper towel. The instrument is then placed in its carrying case.

- **Quarterly:** The instrument is inspected quarterly, even if it has not been used.

The inspection consists of a general examination of the probe, wire, electrical system (battery check) and a calibration check. Any malfunctioning equipment is returned to the manufacturer for repair and recalibration.

## Thermometers

- **Each use:** Before each use, thermometers are visually checked for cracks and mercury separation.

After use, thermometers are rinsed with deionized or distilled water and placed in their protective case to prevent breakage.

- **Monthly:** Thermometers are visually inspected as described above, whether used or not. They are checked against an NBS certified thermometer for accuracy.

**Note:** Replacement equipment will be procured in the event that an instrument(s) must be sent to the manufacturer for maintenance.

#### **6.11 Specific Routine Procedures Used to Assess Data Precision, Accuracy, and Completeness**

Precision is an estimate of the reproducibility of a method, and it is estimated by several statistical tests: the standard deviation of the error distribution, the coefficient of variation and the relative percent difference between replicate (duplicate) samples. The engineering subcontractor will determine the precision of a method by analyzing replicate data.

Precision is then defined by the coefficient of variation (CV), which expresses the standard deviation as a percentage of the mean. An indicator of CV, relative percent difference will serve as quality criterion to classify data resulting from this investigation.

Specific statistical comparison of duplicate samples (field and laboratory), as a measure of precision evaluating both sample collection procedures and laboratory instrument performance, may be accomplished by first comparing the obtained duplicate results with the published EPA criteria for method precision (relative percent difference).

The accuracy of a method is an estimate of the difference between the true value and the determined mean value. Specific statistical comparison of percent recovery values reported by the laboratory as a measure of method accuracy will be compared with the published EPA (or other appropriate regulatory entity) criteria for the accuracy of an individual method. Another technique for evaluating the accuracy of a method is to use the Student's *t*-test. This test identifies whether a significant bias is present.

Data completeness will be expressed both as the percentage of total tests conducted and required in the scope of work that are deemed valid. Methods for assessing data precision, accuracy, and completeness by the laboratory will be outlined in the approved laboratory QAP.

## **6.12 Corrective Action**

Field personnel are responsible for seeing that field instruments and equipment are functioning properly and that work progresses satisfactorily. The field personnel are also responsible for ensuring that routine preventive maintenance and QC procedures are performed, thereby ensuring valid field data are collected. If a problem is detected by the field personnel, the project manager shall be notified immediately, at which time problem correction will begin. Similarly, if a problem is identified during a routine audit by the project QA officer or the regulatory QA officer, an immediate investigation will be undertaken and corrective action deemed necessary will be taken as early as possible.

If corrective action is required by the analytical laboratory, it should be conducted in accordance with NFESC-approved QAP following guidelines provided in NEESA 20.2 -047B, Chapter 4.5 — Out-of-Control Events.

## **6.13 Quality Assurance Reports to Management**

### **6.13.1 Internal Reports**

The engineering subcontractor's QA Officer will provide status reports to the Project Manager. The reports address the following, as applicable during the course of the project:

- QA activities and quality of collected data.
- Equipment and calibration and preventive maintenance.
- Results of data precision and accuracy calculations.
- Evaluation of data completeness.
- QA performance and system audit findings.
- QA problems and recommended and/or implemented corrective actions. Results of corrective action taken.

The laboratory is required to submit a monthly QC progress report to NFESC.



#### **6.13.2 Reports to NFESC**

The engineering subcontractor will provide a data QA summary (QC Data Report) within the draft CAR for submittal to NFESC. A draft CAR must be submitted to the CHESDIV EIC no later than 90 days after field activities ends.

#### **6.13.3 Reports to MDE**

A final CAR and follow-up report (100% complete draft document) must be submitted to MDE 15 days after EIC approval of the draft CAR.

## **7.0 HEALTH AND SAFETY PLAN**

### **7.1 Introduction**

The following is the HASP for the Stump Neck Annex, VI Work Plan being conducted to:

- a) investigate releases or suspected releases of hazardous waste and/or constituents to determine whether corrective measures are necessary, and b) to screen from further investigation those SWMUs which do not threaten human health or the environment.

### **7.2 Applicability**

The provisions of this plan are mandatory for all on engineering subcontractor employees and subcontractors engaged in onsite operations who will be exposed or have the potential to be exposed to onsite hazardous substances.

Subcontractors may use this HASP as a guide in developing their own plan or may choose to adopt it in full (by giving formal written notice to the engineering subcontractor) the VI HASP. If this plan is adopted, all personnel assigned to field activities for the project must read and sign the plan acceptance form before commencing site activities. At a minimum, all provisions of this HASP will be followed.

Inadequate health and safety precautions by the subcontractor or the belief that the subcontractor's personnel are or may be exposed to an immediate health hazard, can be cause for the engineering subcontractor to suspend the site work and ask the subcontractor to evacuate the hazard area.

All subcontractors, and engineering subcontractor personnel will be responsible for operating in accordance with the most current Occupational Safety and Health Administration (OSHA) regulations including 29 CFR 1910.120 — Hazardous Waste Operations and Emergency Response. These regulations include the following provisions for employees exposed to

hazardous substances, health hazards, or safety hazards: training as described in 120(e), medical surveillance as described in 120(f), and PPE as described in 120(g).

### **7.3 Site Characterization**

#### **7.3.1 Site History**

The EPA has designated three areas at the Stump Neck Annex for investigation: the Rum Point Landfill, Chicamuxen Creek's Edge Dump Site B, and the Air Blast Pond. Figure 2 shows the site locations.

##### **7.3.1.1 Rum Point Landfill (SWMU 1)**

The unit is an unlined landfill west of Rum Point Road, of approximately 1.5 to 2.0 acres. It has been inactive since December 1989 and, according to facility representatives, was used for biodegradable waste disposal. A site inspection conducted in 1983 identified metal parts including garbage cans, 55-gallon drums, a hot water heater, a metal chair, a rusted land mine, and a partially exposed projectile. In addition, ash from the Thermal Treatment Tank (SWMU 16) was disposed of at this facility on a one time basis. Ash composition is reportedly not documented. The most recent ash analysis was conducted in 1993, however, these results are not indicative of the ash disposed in the landfill since the materials treated in SWMU 16 have changed.

The unit is a large, flat, packed dirt area. The northwestern edge of the landfill drops 20 to 30 feet into a wooded area adjacent to an unnamed creek which flows south to north. An eroding, sparsely wooded embankment rises approximately 15 feet above the top of the landfill in its southern section.

##### **7.3.1.2 Chicamuxen Creek's Edge Dump Site B (SWMU 4)**

This unit is reported to be an unlined, grass covered earthen area adjacent to Chicamuxen Creek and in the immediate vicinity of the Old Demolition Range (SWMU 23). A small stand of trees

separates the area from the water's edge. The RCRA Facility Assessment (RFA) states that records indicate the unit was used as a dump site. Facility representatives were unable to provide information on the exact location or the nature of any materials disposed.

#### **7.3.1.3 Air Blast Pond**

This unit, which has been inactive for 15 to 20 years, was an explosive testing area consisting of a 100 foot-diameter earthen pit. Explosives were detonated over water in the pit to measure the concussion factor. The water was periodically discharged into Chicamuxen Creek through industrial outfall IW 32.

The pond is in a wooded area of the facility overgrown with grass, briars, and small trees: approximately 25 steel pipes stand upright on the floor of the pond. In the wooded areas directly surrounding the unit, rusted and corroded drums were observed on leaf-covered soil. During the Visual Site Inspection (VSI), steel cylinders were on the bare soil in the wooded area. Two drainage ditches discharge into an adjacent creek, which appears to flow into Chicamuxen Creek.

According to the fact sheet for the HWMF permit (1990), explosives tested at this site included pentolite, HBX1, HBX2, H6, and C4 propellant.

#### **7.3.2 Site Control**

Site control will be established and maintained according to the recommendations set forth in the EPA's *Interim Standard Operating Safety Guides, Revised September 1982*. Three general zones of operation will be established to reduce the potential for contaminant migration and risk of personnel exposure — the exclusion zone (EZ), the contamination reduction zone (CRZ), and the support zone (SZ). The EZ will be located to include the area between the decontamination station and the site, will be included; the CRA will include the decontamination station and the SZ will be beyond the CRZ. Only authorized personnel with at least 40 hours of health and

safety training meeting the requirements of OSHA 29 CFR 1910.120 are permitted within the EZ and CRZ. The EZ is considered contaminated and all personnel there must use the prescribed level of personal protection. A checkpoint will be established at the periphery of the EZ's periphery to regulate the flow of personnel and equipment in and out of the area. The EZ boundary is the "hotline."

A check in/checkout log will be kept at the checkpoint established at the periphery of the EZ. All personnel crossing the "hotline" will be required to log in as they enter and log out as they leave. The check in/checkout log will include name, signature, site function/reason for visit, company/organization affiliation, and date and time of ingress and egress. The log will be retained at the operations trailer/command post during nonwork hours. An example of log format is provided in Section 7.11 — Forms.

All personnel crossing the hotline into the exclusion zone must be done using the "buddy system."

The "buddy system" as used in this document means that the person entering the exclusion zone is accompanied by a person who is able to:

- Provide his/her partner with assistance.
- Observe his/her partner for signs of chemical or heat/cold exposure.
- Periodically check the integrity of his/her partner's protective clothing.
- Notify the shift supervisor or his representative or others if emergency help is needed.

Additionally, at least one person shall remain outside the EZ and have available at least the same level of PPE as the "buddies" entering the EZ. This person will act as the safety observer and perform the security duties described in Section 7.9 of this plan.

The CRZ, a buffer between the EZ and the SZ, is intended to prevent the spread of contaminants from the work areas. All decontamination procedures will be conducted in this area. Entry into the CZ from the SZ will be through a controlled access point. Personnel entering into this area must wear the prescribed PPE. Exit from the CRZ requires the removal of all contaminants through compliance with established decontamination procedures.

The SZ, the outermost zone, is considered a noncontaminated or clean area. The command post for field operations, first-aid station, and other site support elements are in this area. The location of the command post is determined based on site topography and prevailing wind direction.

Due to the unique nature of this facility as an EOD station, special precautions will be taken to ensure the safety of all personnel. Previous to any and all investigation of known or suspected areas, by engineering subcontractor personnel or their subcontractors, in which ordnance may be interred in an EOD unit, either Naval or civilian contract, shall investigate the area. All such activity will be coordinated with and through the Navy.

### **7.3.3 Site Communications**

Communications between team members (including persons responsible for team safety) will be through the use of intrinsically safe FM radios. Radios will be checked daily before commencing field operations to ensure proper operation. Radios will be maintained in accordance with the manufacturer's recommendations. Due to the nature of this facility, all two-way radio operations will be conducted in accordance with NAVEODTECHCEN instructions and/or SOPs regulating such operations. Activity will be cleared through and coordinated with Navy personnel in charge at all times. These forms of communication will be used to:

- Alert team members of emergencies

- Transmit safety information
- Communicate changes in work schedule or site conditions
- Maintain site control

External communications between onsite and offsite personnel will be through the use of telephones in the site office. Additionally, a fax machine and a personal computer with a modem for data and electronic mail transmissions will be in the site office.

These forms of communication will be used to:

- Coordinate emergency response
- File reports
- Maintain contact with offsite personnel

Safety procedures will be reviewed daily before initiating site activities. This review will include:

- Proper function, and donning and doffing of PPE
- Proper function and maintenance of ambient air monitoring equipment used in conjunction with the site HASP
- Review of emergency response protocol and plans of action
- Field equipment usage and safety considerations
- Changes or recent manifestations of hazardous conditions onsite which may require modification of established procedures

There will only be one work shift per day for the duration of the VI.

#### **7.4 Site Activities**

The activities to be performed during the VI will include surface soil sampling, subsurface soil borings, groundwater monitoring well installation and sampling, and waste material sampling for source characterization.

#### **7.5 Hazard Evaluation**

The following is an analysis of the chemical and physical hazards that may be encountered over the course of this investigation. The hazards are based review of available historic information.

##### **7.5.1 Physical Hazards**

Field personnel should be aware of, and act in a manner to minimize, the dangers associated with physical hazards typically encountered during environmental investigations. These hazards include heat- and cold-related illnesses, severe weather, above-ground and underground utilities, working with and around drill rigs and heavy equipment, uneven terrain, slippery surfaces, and lifting. The poisonous flora and fauna, such as poison ivy and snakes, should be anticipated.

##### **7.5.1.1 Underground Utilities**

Prior intrusive work at this site, the engineering subcontractor will attempt to locate and identify underground utilities by working with the activity Public Works Department and any appropriate utilities.

##### **7.5.1.2 Explosive Ordnance**

A review of the facility history indicates that sites were used for open burn/open detonation (OBOD) of high energy explosives (HMX, RDX, and TNT), ordinance disposal, and disposal of other hazardous and nonhazardous wastes. Only the general locations of the buried ordnance are known. This will be of significant concern when collecting subsurface soil and ground water



are known. This will be of significant concern when collecting subsurface soil and ground water samples at this site. Due to the unique nature of this facility as an explosive ordnance disposal station, special precautions will be taken to ensure the safety of all personnel. Previous to any and all investigation of known or suspected areas, by engineering subcontractor personnel or their subcontractors, in which ordnance may be interned an explosive ordnance disposal (EOD) unit, either Naval or civilian contract, shall investigate the area. All such activity will be coordinated with and through the Navy.

#### **7.5.1.3 Procedures and Equipment for Extreme Hot or Cold Weather**

The Site Supervisor and the Site Health and Safety Officer (SHSO) shall be aware of the potential for heat stress and other environmental illnesses. When environmental or work conditions dictate, work regimens shall be implemented to minimize the potential for employee illness. Field staff will be responsible for monitoring co-workers for signs or symptoms of heat- or cold-induced illness.

Due to the ambient environmental conditions typical the area, the heat index and/or core body temperature (area and/or personal) will be monitored during hot weather and/or when elevated levels of PPE are used. In addition to using various work-rest regimens, employees also will use cool vests to help control core body temperature when conditions dictate.

#### **7.5.1.4 Severe Weather**

Field work shall not be conducted when lightning can be seen from the work area. When lightning is observed, cease work, perform emergency personal and equipment decontamination as needed, then seek shelter.

During extreme weather conditions, the Site Supervisor shall use his/her best judgment and has the authority to stop field work or dismiss workers for the day. Examples of conditions that may warrant work stoppage include: high winds, hail, flooding, and ice storms.

#### **7.5.1.5 Confined Space Entry**

E/A&H is concerned about employee safety when working in or around confined spaces. Therefore, engineering subcontractor personnel are required to characterize the potential hazards associated with entering any confined space. Refer to the following definitions for space characterization information.

***Confined Space*** — A space that is: (1) large enough and so configured that an employee can bodily enter and perform assigned work; (2) has limited or restricted means for entry or exit; and (3) is not designed for human occupancy. Confined spaces may include, but are not limited to, storage tanks, manholes, process vessels, bins, boilers, ventilation or exhaust ducts, sewers, underground utility vaults, tunnels, pipelines, trenches, vats, and open-top spaces more than 4 feet deep such as pits, tubs, vaults, or any place with limited ventilation.

***Permit-Required Confined Space (permit space)*** — A confined space with one or more of the following characteristics: (1) contains or has the potential to contain a hazardous atmosphere; (2) contains a material that can engulf an entrant; (3) has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross section; or (4) contains any other recognized serious safety or health hazard.

***Non-permit Confined Space*** — A confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

**NOTE: ENGINEERING SUBCONTRACTOR PERSONNEL SHALL NOT PERFORM PERMIT- OR NON-PERMIT-REQUIRED CONFINED SPACE ENTRY WITHOUT FIRST OBTAINING WRITTEN APPROVAL FROM A COMPANY PRINCIPAL AND THE PROJECT HEALTH AND SAFETY MANAGER. ALL CONFINED SPACE ENTRY WILL BE SUPERVISED BY THE PROJECT HEALTH AND SAFETY MANAGER, AND WILL BE CONDUCTED WITH RESPECT TO 29 CFR 1910.146.**

It is not anticipated that an engineering subcontractor or subcontractor personnel will be required to perform permit- or non-permit-required confined space entry to collect samples. However, if field conditions warrant performance of confined space entry for sample collection or investigation purposes, it will be conducted under the requirements of 29 CFR 1910.146.

#### **7.5.2 Chemical Hazards**

An initial hazard evaluation will be conducted at the site prior to initiation of site work. The initial hazard evaluation will include air monitoring and soil sampling to determine which contaminants, if any, are present. Upon completion of the initial site sampling, health hazards from other site contaminants, if any, will be evaluated.

#### **7.6 Employee Protection**

Employee protection for this project includes standard safe work practices, PPE, procedures and equipment for extreme weather conditions, work limitations, and exposure evaluation. The potential physical/chemical hazards posed by the site are summarized in Table 7-1.

Table 7-1  
 Potential Physical and Chemical Hazards

Field Activity	Mechanical Equipment Used	Electrical Hazard	Chemical Hazard	Physical Hazard	Temperature Hazard	Ordinance
Surface soil sampling	None	None	Inhalation of dust particles, vapors, or gases. Accidental ingestion, skin absorption, eye contact.	Slip, trip, fall.	H/C Stress	Explosives
Subsurface soil sampling	Auger	Check to make sure there are no underground electrical cables	Inhalation of dust particles, vapors, or gases. Accidental ingestion, skin absorption, eye contact.	Slip, trip, fall.	H/C Stress	Explosives
Groundwater monitoring well install.	Drill Rig	None	Inhalation of dust particles, vapors, or gases. Accidental ingestion, skin absorption, eye contact.	Struck by, caught between, pinch points on machinery. Slip, trip, fall. Noise.	H/C Stress	Explosives
Surface water sampling	Boat	None	Inhalation of vapors, or gases. Accidental ingestion, skin absorption, eye contact.	Slip, trip, fall. Drowning. All work on or near bodies of water require CG-approved life jackets.	H/C Stress	Explosives

### **7.6.1 Standard Safe Work Practices**

Standard safe work practices that will be followed include:

- Eating, drinking, chewing gum or tobacco, smoking, or any activity that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any area designated as contaminated, unless authorized by the SHSO.
- Hands and face must be thoroughly washed upon leaving the work area.
- Contact lenses shall not be worn on site.
- Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.
- Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, do not walk through puddles, leachate, or discolored surfaces, or lean, sit, or place equipment on drums, containers, or soil suspected of being contaminated.
- Medicine and alcohol can exacerbate the effects from exposure to toxic chemicals. Prescribed drugs should not be taken by personnel on cleanup or response operations where the potential for absorption, inhalation, or ingestion of toxic substances exists unless specifically approved by a qualified physician. Consumption of alcoholic beverages is prohibited during operations.
- Undergarments should be made from natural fibers (i.e., cotton or wool).

### **7.6.2 Personal Protective Equipment**

All site investigation activities will be initiated in modified Level D PPE consisting protective foot and eyewear, hard hat when working around overhead hazards or heavy equipment, and protective coveralls (optional) and nitrile gloves. This level of protection is based on the activities planned at the site and upon review of potential chemical and physical hazards at the site.

Additionally, if the concentrations of respirable airborne dust contaminants exceed  $5 \text{ mg/m}^3$  or the total concentration of airborne dust contaminants exceed  $15 \text{ mg/m}^3$ , a minimum of Level C respiratory protection will be required.

### **7.6.3 Work Limitations**

All site activities will be conducted during daylight only. All personnel scheduled for these activities will have completed initial health and safety training which includes recognizing the symptoms and signs of overexposure to the chemical hazards present at this site. Prior to starting work at the site, each employee must have three days of actual field training under the supervision of and experienced supervisor as specified in 29 CFR 1910.120. All supervisors must complete eight hours of site management training. All personnel must complete an eight-hour refresher training course annually in order to continue working onsite.

### **7.6.4 Exposure Evaluation**

All personnel scheduled for site activities will have a baseline physical examination which will include a physical examination, stressing examination of the neurologic, cardiopulmonary, musculoskeletal and dermatological systems; pulmonary function testing; multichemistry panel and urinalysis; and be declared fit for duty. An exposure history form will be completed for each worker participating in site activities. An examination and updated occupational history will be repeated annually and upon termination of employment as required by 29 CFR 1910.120(f). The content of the annual/termination examination will be the same as the

baseline physical. A qualified physician will review the results of the annual/termination examination and exposure data and request further tests or issue medical clearances as appropriate.

After any job-related injury or illness, there will be a medical examination to determine fitness for duty or for the need of any job restrictions. The SHSO will review the results with the examining physician before releasing the employee for work. A similar examination will be performed if an employee has missed at least three days of work due to a non-job-related injury or illness requiring medical attention. Medical records shall be maintained by the employer or the physician for at least 30 years following the termination of employment.

#### **7.7 Monitoring Requirements**

Initial air monitoring will be accomplished using a PID, an oxygen/flammable gas detector, an H<sub>2</sub>S detector, and, Mini-Ram will be used to monitor dust particle concentrations.

A field calibration check will be performed on each instrument daily before beginning site work, at the end of each workday and at other times as deemed appropriate by the SHSO. Each instrument will be maintained in accordance with the manufacturer's recommendations.

#### **7.8 Decontamination**

A decontamination zone will be established at each of the two work site entrances which will include an area for sampling equipment and personnel decontamination.

##### **7.8.1 Personnel Decontamination**

The decontamination procedures, based on Level B protection, will consist of the following:

1. Brushing heavily soiled boots, rinsing outer gloves and boots with soap and water
2. Rinsing and removing facepiece and air bottle

3. Removing outer gloves depositing them in a plastic lined container
4. Washing and rinsing safety suit, removing safety suit and boots

Safety suits are to be deposited in a plastic-lined container then wash and rinse inner gloves, remove facepiece, wash and rinse inner gloves and remove inner gloves. Facepieces will be decontaminated and cleaned for reuse; inner gloves will be deposited in a plastic-lined container. The decontamination procedures for Level C protection will be similar. Decontamination procedures will be conducted at the lunch break and at the end of each workday. If the field activities zone is left at other times during the workday, contaminated clothing will be left at the decontamination station on plastic sheeting to be reworn on returning.

If higher levels of PPE are needed, adjustments will be made to these procedures and an amendment will be made to this health and safety plan.

#### **7.8.2 Closure of the Personnel Decontamination Station**

All disposable clothing and plastic sheeting used during site activities will be double-bagged and disposed in a refuse container. Decontamination and rinse solutions will be allowed to drain onsite. Reusable clothing will be dried and prepared for reused. All washtubs, pails, buckets, etc., will be washed, rinsed, and dried at the end of each workday.

#### **7.9 Authorized Personnel**

Personnel anticipated to be onsite at various times during site activities include:

- |  |                  |
|--|------------------|
| • CHESDIV/EIC                                    | Donna Jordan     |
| • NOS Indian Head                                | Sherry McCahill  |
| • NAVEODTEHCEN                                   | Jack Meyers      |
| • Engineering Subcontractors Principal-in-Charge | To be determined |
| • Engineering Subcontractors Site Manager        | To be determined |



- Engineering Subcontractors Safety Officer      To be determined
- Engineering Subcontractors Representatives      To be determined

#### **7.9.1 Responsibilities of Engineering Subcontractor Site Manager**

The project manager will direct the site investigation and operation. The project manager has the primary responsibility for:

- Assuring that all personnel are aware of:
  - Names of personnel and alternates responsible for site safety and health;
  - Safety, health and other hazards present onsite;
  - Use of PPE and ensuring that the equipment is available;
  - Work practices by which the employee can minimize risks from hazards;
  - Safe use of engineering controls and equipment on the site;
  - Medical surveillance requirements including recognition of symptoms and signs which might indicate over exposure to hazards; and
  - Site control measures, decontamination procedures, site standard operating procedures and the contingency plan and responses to emergencies including the necessary PPE.
- Ensuring that all employees have received at least 40 hours of health and safety instruction, offsite, and actual field experience under the direct supervision of a trained,

experienced supervisor. Workers who may be exposed to unique or special hazards shall be provided additional training.

- Monitoring the performance of personnel to ensure that mandatory health and safety procedures are being performed and correcting any performances that do not comply with the HASP.
- Ensuring that all field personnel employed onsite are covered by a medical surveillance program as required by 29 CFR 1910.120(f)
- Consulting with the SHSO and/or other personnel.
- Preparation and submittal of any and all project reports includes progress, accident, incident, contractual, etc.

#### **7.9.2 Responsibilities of Site Health and Safety Officer**

- Assure that a copy of the health and safety plan is maintained onsite during all field activities.
- Advise the project/site manager on all health and safety-related matters involved onsite.
- Direct and ensure that the safety program is being correctly followed in the field, including the proper use of personal protective and site monitoring equipment.
- Ensure that the field personnel observe the appropriate work zones and decontamination procedures.
- Report any safety violations to the project manager.

- Conduct safety briefings during field activities.

Initially, the SHSO will be a person trained in safety and industrial hygiene. After the project begins and the site safety officer has had time to evaluate actual hazardous site conditions, he/she may determine that a member of the project team may assume the duties of SHSO.

### **7.9.3 Responsibilities of Onsite Field Personnel**

- All personnel going onsite must be thoroughly briefed on anticipated hazards and trained on equipment to be worn, safety procedures to be followed, emergency procedures, and communications.
- Required respiratory protective devices and clothing must be worn by all personnel going into areas designated for wearing protective equipment.
- Personnel must be fit-tested before using respirators.
- No facial hair that intrudes on the sealing surface of the respirator is allowed on personnel when respiratory protection is required.
- Personnel onsite must use the buddy system, especially when wearing respiratory protective equipment. As a minimum, a third person, suitably equipped as a safety backup, is required during all entries requiring respiratory protection.
- Visual and/or radio contact must be maintained between pairs onsite and site safety personnel. Field personnel should remain close to assist each other during emergencies.

- All field personnel should make use of their senses to alert themselves to potentially dangerous situations which they should avoid, e.g., presence of strong and irritating or nauseating odors.
- Personnel should practice unfamiliar operations prior to doing the actual procedure in the field.
- Field personnel shall be familiar with the physical characteristics of the site, including:
  - Wind direction in relation to contamination zones
  - Accessibility to associates, equipment and vehicles
  - Communications
  - Operation zones
  - Site access
  - Nearest water sources
- Personnel and equipment in the contaminated area must be kept to a minimum, consistent with effective site operations.
- Procedures for leaving a contaminated area must be planned and implemented prior to going onsite in accordance with the site HASP.
- All visitors to the job site must comply with the HASP procedures. PPE may be modified for visitors depending on the situation with the SHSO's approval.

#### **7.10 Emergency Information**

All hazardous waste site activities present a risk to onsite personnel. During routine operations, risk is minimized by establishing good work practices, staying alert, and using PPE.

Unpredictable events such as physical injury, chemical exposure, or fire may occur and must be anticipated.

If any situation or unplanned occurrence requires outside assistance or support services, Navy representatives will be informed and the appropriate contact from the following list will be made:

- Law Enforcement, Charles County Sheriff's Office (301) 934-2222
- Fire Department, Charles County Fire Board (301) 934-2211
- Ambulance Services, Charles County Business (301) 934-2214
- Regional Poison Center, Maryland Poison Center (Waldorf) 1-800-492-2414

#### **7.10.1 Site Resources**

Telephones for communications with outside agencies and an emergency are at the site office. Portable radios, coordinated with Navy personnel, will be used for onsite communications. A first-aid kit, stretcher, eye wash station, and other emergency supplies are in the site office. Restroom facilities and water supply are available near the site office.

#### **7.10.2 Emergency Procedures**

If an emergency develops onsite, the procedures delineated herein are to be immediately followed. Emergency conditions are considered to exist if:

- Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while onsite; or
- A condition is discovered that suggests the existence of a situation more hazardous than anticipated.

The following emergency procedures should be followed:

- Report any emergency situation, such as fire, or personnel injury immediately to the project manager.
- Emergency alerting will be accomplished by use of radios, if conditions allow for the safe use (coordinate with Navy), or through hand signals.
- EZ will be evacuated through the hotline control point. After emergency decontamination, all personnel will muster at the command post/site office. All other people onsite who are not in the EZ will evacuate the site through the nearest exit but may not cross through the EZ.
- If any member of the field team experiences any effects or symptoms of exposure while onsite, the entire field crew will immediately halt work and act according to the instructions provided by the SHSO.
- For applicable site activities, wind indicators visible to all onsite personnel will be provided by the SHSO to indicate possible routes for upwind escape.

The discovery of any conditions that would suggest a situation more hazardous than anticipated will result in the suspension of work until the SHSO has evaluated the situation and provided the appropriate instructions to the field team. During this evaluation, all personnel in the EZ will muster in the CRZ.

- In a fire or other disaster, evacuate the EZ, muster in the CRZ and notify local authorities of the incident.

- In an accident, decontaminate the injured person, as well as any persons accompanying the injured person to the hospital. A minimal level of decontamination will be needed to prevent contamination of the hospital and medical personnel. Care must be exercised so as not to cause further or additional injury to the individual.
- In an emergency, entry into the EZ will initially be controlled by the site manager and will be limited to life-saving operations.
- Emergency response beyond evacuation of the EZ and operations necessary for life saving shall not be attempted by onsite personnel. Those type operations will be left for organizations who have been trained for these type activities (e.g. fire department).
- If an accident occurs, the project manager is to complete an accident report form for submittal to the managing principal-in-charge of the project.
- This contingency plan shall be updated whenever changes occur which may affect the effective implementation. After each incident/accident, the effectiveness of this plan shall be evaluated and the plan shall be modified as needed.
- If a release threatens the streams, creeks or rivers; or if a release occurs on the land surrounding the site, notify:
  - Maryland Department of Environment,  
Baltimore, Maryland  
(301) 631-3424
  - Hazardous and Solid Waste Management  
(24-hour) (301) 974-3551
  - Maryland Emergency Management & Civil Defense  
(24-hour) (301) 486-4422

Primary responsibility for notification of local authorities will be vested in the Site Project Manager or his designated alternate.

#### **7.11 Forms**

The following forms will be used in implementing this health and safety plan:

- Plan Acceptance Form
- Plan Feedback Form
- Accident Report Form
- Exposure History Form

The Plan Acceptance Form will be filled out by all employees working onsite before site activities begin. The Plan Feedback Form will be filled out by the SHSO and any other onsite employee who wishes to do so. The Accident Report Form will be filled out by the Project Manager if an accident occurs. The Exposure History Form will be completed by both the project manager and the individual(s) for whom the form is intended.

All completed forms must be returned to the Principal-in-Charge.

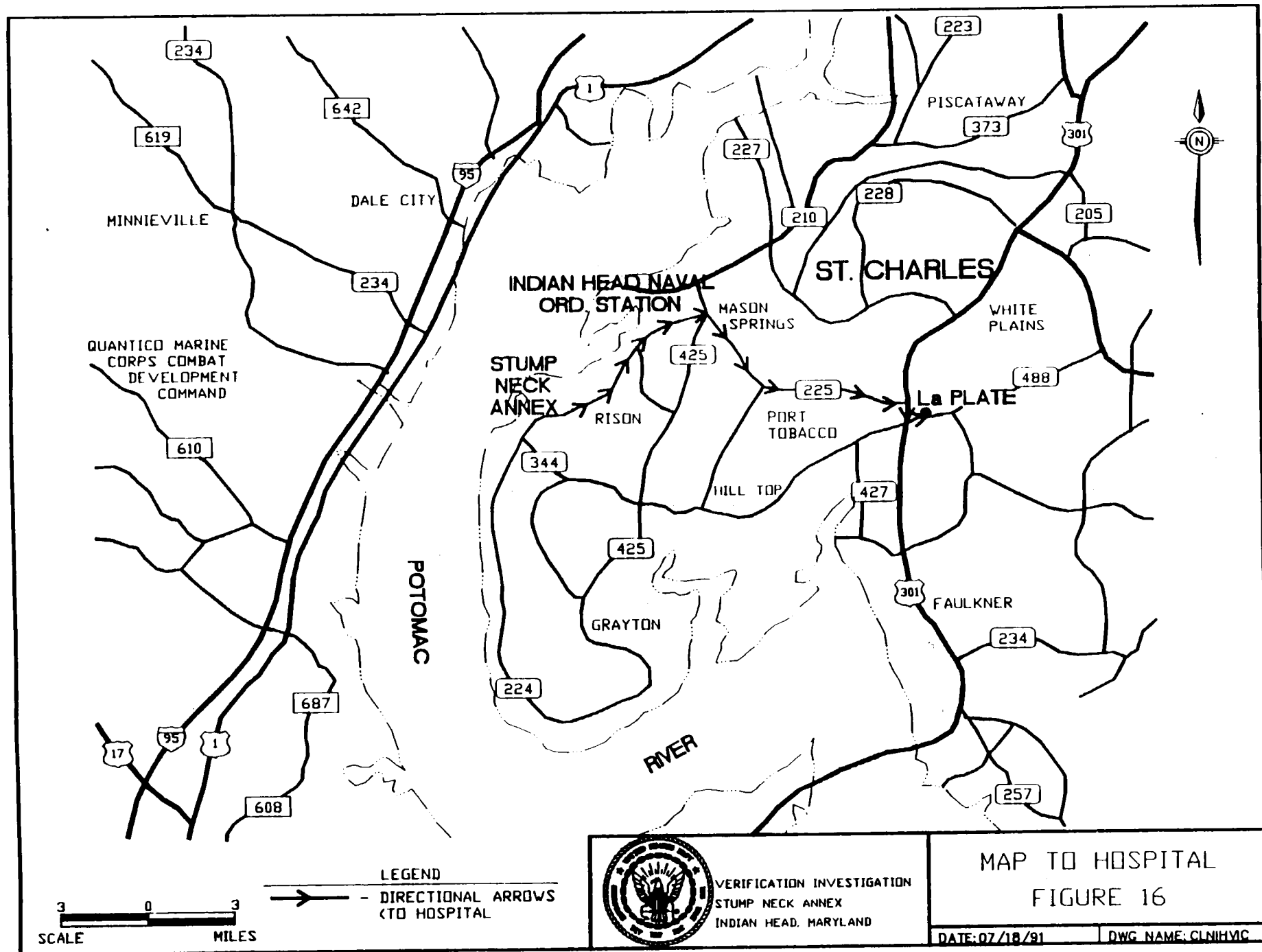


**LOCATION OF THE NEAREST HOSPITAL  
CAPABLE OF TREATING CHEMICAL EXPOSURES**

Physicians Memorial Hospital  
701 East Charles Street  
LaPlata, Maryland 20646  
Telephone: (301) 645-0100 or (301) 934-4633

**Directions:**

Depart NAVEODTEHCEN, turn left onto MD 224 to MD 225. Turn right onto MD 225 to Route 301. Turn right onto Route 301 to Route 6. Turn left onto Route 6 to Physicians Memorial Hospital. See Figure 16 for map to the hospital.



**PLAN ACCEPTANCE FORM**

**PROJECT HEALTH AND SAFETY PLAN**

**INSTRUCTIONS:** This form is to be completed by each person working on the project work site and returned to the engineering subcontractor.

Job No. \_\_\_\_\_

Project \_\_\_\_\_

I represent that I have read and understand the contents of the above plan and agree to perform my work in accordance with it.

\_\_\_\_\_  
Signed

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Company

\_\_\_\_\_  
Date

**PLAN FEEDBACK FORM**

Problems with plan requirements:

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Unexpected situations encountered:

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Recommendations for revisions:

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**EMPLOYEE EXPOSURE HISTORY FORM**

EMPLOYEE NAME: \_\_\_\_\_

JOB NUMBER: \_\_\_\_\_

DATE(S) ON SITE (FROM/TO): \_\_\_\_\_

HOURS ONSITE: \_\_\_\_\_

**CONTAMINANTS (SUSPECTED/REPORTED)**

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

(SEE ATTACHED LABORATORY ANALYSIS)

## **8.0 POTENTIAL CORRECTIVE MEASURES**

The nature of the potential wastes associated with Rum Point Landfill, Chicamuxen Creek's Edge Dump Site B, and the Air Blast Pond, as well as the physical characteristics of the facility, will dictate the choice of corrective measures technologies which may be appropriate. Since the nature and extent of contamination are currently unknown, evaluation of potential corrective methods is speculative and based on the assumption that some or all of the contaminants tested for will be present in significant quantities. Present characterization of site geology, soils, surface water, hydrogeology, groundwater, and sediments is extrapolated from regional data.

### **8.1 Data Requirements**

Available data indicate that the near-surface groundwater aquifer present at Stump Neck Annex is hydrologically connected to the adjacent surface water systems and flow appears to be mostly lateral in nature. The area is part of the Potomac River estuary and as such is subject to tidal, diurnal, and seasonal influences which allow for fluctuations in the quality and position of the groundwater. Soil in the area is typically silty loam, exhibiting a relatively low permeability, and tidal marsh.

To evaluate the potential of the various technologies available it is necessary to collect extensive, detailed, and accurate geologic, soil, surface water, hydrogeologic, groundwater, sediment, and contamination data. The methods of data collection are described in Section 5 of this document.

### **8.2 Available Technologies**

#### **8.2.1 Extraction Methods**

##### **Pump-and-Treat Systems**

Pump-and-treat systems are capital and maintenance cost intensive. The effectiveness of a pump-and-treat system depends upon the aquifer characteristics and the chemical nature of the contaminant. Such systems probably will not remediate an aquifer to required levels without some form of complementary technology.

Given what is currently known about the facility, pumping systems do not appear to be appropriate. The reported low soil permeabilities and the interconnection of hydrologic provinces preclude effective treatment by such methods.

### **Soil Vapor Extraction**

Soil vapor extraction techniques require fairly permeable, unsaturated soil. The success of this technique depends on the volatility of the contaminant and the ability to sufficiently dewater the upper groundwater regime.

### **8.2.2 In Situ Remediation Technologies**

In Situ biodegradation techniques show promise for sites in which an indigenous microbial population exists and is capable of using the contaminants as a food stock. It will be necessary to implement biological testing of soil and groundwater samples in order to determine the presence of the bacteria, their viability, and nutrient requirements. If such microorganisms exist, and are capable of degrading the contaminants present, enhancing their environment may prove to be a viable method of site remediation.

### **8.2.3 Excavation and Disposal**

Excavation of contaminated soil and cessation of contaminating operations will effectively remove the source of the problem. It is then necessary to dispose of the contaminated soil properly. The available options for disposal are landfilling and incineration.

### **Landfilling**

Excavating and landfilling contaminated soil, on or offsite, must consider pertinent local, state, and federal regulations. Extensive permitting requirements may make this approach unworkable.

### **Incineration**

Incinerating contaminated soil will reduce the volume of waste product, but there must still be a final disposition of the residue. The regulations pertaining to soil incineration may require extensive efforts toward permitting.

### **8.3 Source Control**

Considering the nature of the potential contamination, the proximity of the surface water, probable hydrologic interface between the aquifer and the surface water, depth to groundwater, and the relative impermeability of the soils, remediation methods directed toward groundwater are probably not viable. Removal of the source of contamination in conjunction with soil remediation appears to be the best alternative thus far. Further information is necessary to make a final determination.



## **9.0 COMMUNITY RELATIONS PLAN**

In 1991, a permit was issued by the EPA under the authority of the Solid Waste Disposal Act as amended by the RCRA and the HSWA, to the U.S. Department of the Navy to meet the requirements of HSWA at the NAVEODTECHCEN at Stump Neck Annex, Indian Head, Maryland. The purpose of this permit is to provide the EPA, interested citizens, and other governmental agencies the opportunity to evaluate the ability of the Permittee to comply with the permit requirements. EPA has prepared a draft permit summarizing all the requirements the permittee is expected to comply with during the 10-year duration of the permit. The public was given 45 days to review and comment on the draft permit before the EPA takes any action on the final draft.

This permit requires the Navy to conduct a VI and RCRA Facility Investigation (RFI). If the sites exhibit contamination, further studies will be instituted.

Information of any noncompliance that may endanger human health or the environment, such as hazardous waste or its constituents endangering the public water supply, fire or explosion, will be orally provided to the EPA Regional Administrator within 24 hours of the incidents occurrence.

## **10.0 REFERENCES**

RCRA Facility Assessment Report of the Naval Explosive Ordnance Disposal Technology Center Stump Neck Annex, Indian Head, Maryland (RFE Report). EPA I.D. Number MD4170090001. Dated 1989.

U.S.G.S. Quadrangle Indian Head Topographical Map.

Initial Assessment Study, Naval Ordnance Station, Indian Head, Maryland. UIC: N00174

Outbrief Naval Explosive Ordnance Technology Center. Dated November 5, 1990.

Sampling and Analysis Quality Assurance Requirements for the Navy Installation Restoration Program. NEESA 20.2-047b. Dated June, 1988.

Ground-Water Monitoring Guide. NEESA 20.2-031a. Dated February, 1985.

## **Appendix A**

### **Analytical Data Validation Checklist**

### Field Data Validation Checklist

Project Name: \_\_\_\_\_  
Project Number: \_\_\_\_\_  
Sample Identification: \_\_\_\_\_  
Sampling Team: \_\_\_\_\_  
Analyzing Laboratory: \_\_\_\_\_  
Analyses Performed: \_\_\_\_\_  
Sample Matrix: \_\_\_\_\_  
QA Reporting Level: \_\_\_\_\_

#### REPORTING REQUIREMENTS

##### Field Data Package Documentation

Yes

No

Not  
Required

1. Field (water and soil sample logs completed properly and signed?
2. Sampling dates noted?
3. Sampling team indicated?
4. Sample identification traceable to location collected?
5. Sample location provided?
6. Sample depth for soils indicated?
7. Collection technique (bailer, pump, etc.)?
8. Field preparation techniques and sample type indicated (grab, composite)?
9. Sample container type described?
10. Sample container type proper for analysis?
11. Preservation methods indicated?
12. Chain-of-custody form completed?
13. Proper analytical methods requested?
14. Proper number and type of field QC samples were collected (blanks, duplicates, splits, etc.)?
15. Field equipment was properly calibrated before use and results documented?

Comments: \_\_\_\_\_

Field Documentation is Complete: \_\_\_\_\_

QA Officer

## Analytical Data Validation Checklist

Project Name: \_\_\_\_\_  
Project Number: \_\_\_\_\_  
Sample Identification: \_\_\_\_\_  
Sampling Team: \_\_\_\_\_  
Analyzing Laboratory: \_\_\_\_\_  
Analyses Performed: \_\_\_\_\_  
Sample Matrix: \_\_\_\_\_  
QA Reporting Level: \_\_\_\_\_

### REPORTING REQUIREMENTS

#### Analytical Data Package Documentation

#### Level A (Qualitative)

	<u>Yes</u>	<u>No</u>	<u>Not Required</u>
<b>Section I: General Information</b>			
1. Sample results complete?			
2. Proper parameters analyzed?			
3. Method of analysis reported?			
4. Detection limits of analysis reported?			
5. Master tracking list provided?			
6. Sample collection date provided?			
7. Sample received date provided?			
8. Sample preparation/extraction date provided?			
9. Sample analysis date provided?			
10. Copy of Chain-of-Custody form signed by the lab sample custodian?			
11. A narrative summary of QA or sample problems is provided?			

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Section II: Inorganic Analyses**

Yes

No

Not  
Required

1. Results of ICVS and CCVS, %R, expected values?
2. Results of Digested LCS (may be called QC Check sample), %R and expected value?
3. Results of undigested QC Check sample, %R, Source (Lot No. and manufacturer)?
4. Results of method blanks?
5. Results of interference check sample ICS and expected value (ICP only)?
6. Results of a dilution check sample and expected value (ICP only)?
7. Results of laboratory duplicate analysis and %RSD or RPD and control?
8. Results of matrix spike (digested spike) analysis, amount spiked, %R and control limits?
9. Results of analytical (post-digested) spike analysis, amount spiked, %R, and control limits (furnace AAS only)?

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## DOCUMENTATION

### Section II: Inorganic Analyses

Yes   No

Not  
Required

#### A. GAS CHROMATOGRAPHY (NO MASS SPEC)

1. Results of water blanks (VOA), extraction blanks, and/or trip blanks?
2. Results of latest independent QC check samples, expected value %R and source (Lot No. and manufacturer)?
3. Results of analysis of reagent water spike, expected value %R, control limits?
4. Results of reagent water spike duplicate, expected value, %R, RPD and control limits?
5. Results of matrix spikes, amount spiked, %R and control limit?
6. Results of matrix spike duplicates, amount spiked, %R, RPD or %RSD and control limit?
7. Results of laboratory duplicates (if performed), RPD or %RSD and control limit?
8. Results of surrogate spikes, %R, control limits?

Comments: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## DOCUMENTATION

			<u>Not</u>
			<u>Required</u>
B.	GAS CHROMATOGRAPHY/MASS SPECTROMETER	<u>Yes</u> <u>No</u>	
1.	Verification statement acknowledging tuning with BFB or DFTPP that indicates compliance with acceptance criteria?		
2.	Results of continuing calibration standards (SPCC and CCC), expected value?		
3.	Results of water blanks, extraction (method) blanks, and trip blanks?		
4.	Results of analysis of reagent water spike, expected value, %R, control limits?		
5.	Results of reagent water spike duplicate, expected value, %R, RPD, and control limits?		
6.	Results of matrix spikes analysis, amount spiked, %R, and control limits?		
7.	Results of matrix spike duplicate analysis amount spiked, %R, RPD or %RSD and control limits?		
8.	Results of surrogate spike analysis, %R, control limits?		
9.	Results of latest Independent QC check samples (EPA or NBS traceable) analyzed expected value, and source (Lot No. and manufacturer)?		
10.	Results of blank spike analysis for matrix spike or matrix spike duplicate parameters not meeting recovery requirements?		

Comments: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



**Quantitative Statistical Significance  
Level B (Quantitative)**

**Data Evaluation**

Pass

Fail

Not App

1. Samples were properly collected?
2. Samples were properly preserved?
3. Field measurements of pH and specific conductance are consistent with historical data?
4. Samples were analyzed by the proper methods?
5. Sample extracted within holding time?
6. Sample analyzed within holding time?
7. Required detection limits were employed by the laboratory?
8. Results of sampler rinsate blanks were contaminant-free or less than five times the detection limit?
9. Sampler rinsate blanks were not contaminant-free and field blanks were analyzed properly?
10. Field blanks were contaminant-free?
11. Field blanks were not contaminant-free and trip blanks were properly analyzed?
12. Trip blanks were contaminant-free?
13. Trip blanks were not contaminant-free?
14. Laboratory blanks (method blanks, extraction blanks, water blanks) are contaminant-free?
15. Blanks summary (conclusions reached): \_\_\_\_\_  
\_\_\_\_\_
16. RPD of field replicates is less than 25% for water matrices and less than 40% for soil matrices or the difference can be explained?

Comments: \_\_\_\_\_  
\_\_\_\_\_

**Inorganic Analyses**

**Pass**    **Fail**

**Not App**

1. ICVS and CCVD %R within control limits?
2. LCS %R within control limits?
3. QC Check Sample %R within control limits and source given?
4. Laboratory blanks acceptable?
5. Interference Check sample within control limits (ICP only)?
6. Dilution Check sample within control limits (ICP only)?
7. RPD for laboratory duplicate within allowable limits?
8. Matrix spike %R within control limits?
9. Analytical post digested spike within control limits (furnace AAS only)?

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Organic Analyses**

Pass

Fail

Not App

1. Laboratory blanks are acceptable?
2. QC check samples %R were within control limits and source given?
3. GC/MS properly tuned with BFB or DFTPP?
4. GC/MS continuing calibration (SPCC and CCC) standards within acceptable control limits?
5. Matrix spikes or reagent water spikes %R within control limits?
6. Matrix spike duplicates %R within control limits?
7. RPD of matrix spike duplicate or reagent water spike duplicate was within control limits?
8. Surrogate spikes within control limits?
9. Laboratory duplicates have acceptable RPD?

Comments: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Data Validation Qualifier Codes  
for Organic Analyses**

The analytical data validation level is (check one):

Explanation: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Final Conclusion: \_\_\_\_\_

Validation Performed By: \_\_\_\_\_

**Reporting Qualifiers:**

- U code: Indicates that compound was analyzed for but not detected. Report the minimum detection limit for the sample with the U (e.g., 10U) based on necessary concentration/dilution actions. (This is not necessarily the instrument detection limit.) The footnote should read: U-Compound was analyzed for but not detected. The number is the minimum attainable detection limit for the sample.
- J code: Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed or when the mass spectral data indicate the presence of a compound meets the identification criteria but the result is less than the specified detection limit but greater than zero (e.g., 10J).
- C code: This flag applies to pesticide parameters where the identification has been confirmed by GC/MS. Single component pesticides > 19 bg.yk in the final extract should be confirmed by GC/MS.
- B code: This flag is used when the analyte is found in the blank as well as a sample. It indicates possible/probably blank contamination and warns the data user to take appropriate action.
- E code: Indicates a value estimated or not reported due to the presence of interference. Explanatory note included on cover page.
- R code: Indicates spike sample recovery is not within control limits.
- S code: Indicates value determined by Method of Standard Addition.
- \* code: Indicated duplicate analysis is not within control limits.
- + code: Indicates the correlation coefficient for method of standard addition is less than 0.995.
- Other: Other specific flags and footnotes may be required to properly define the results. If used, they must be fully described and such description attached to the data summary report.

**Data Classification Summary Checklist**  
**Class A Criteria**  
**Matrix: Groundwater**

To be classified for Class A use, the data must meet the following criteria:

Criteria	Evaluation Result
1. Sampling dates were recorded.	
2. Signatures of Sampling Team on each water sample log or soil sample log.	
3. Sampling locations were clearly designated and described.	
4. Sampling depth increment for soils was recorded.	
5. Sample collection technique was described on water sample log or soil sample log.	
6. Field preparation techniques were clearly described where applicable.	
7. Sample preservation techniques were clearly described, consistent, and adequate for the parameters to be analyzed and the sample matrix.	
8. Shipping bill of lading or constant surveillance documentation is available.	
9. The laboratory sample preparation or extraction date is recorded and available.	
10. The laboratory sample analysis date is recorded and available.	
11. The laboratory sample preparation technique is recorded and available either in the laboratory report or in the laboratories approved SOP.	
12. The methods of analysis are listed in the laboratory reports and are consistent with the methods specified in the QAP and laboratory contract.	

**Class A Criteria (continued)**

Criteria	Evaluation Result
13. The laboratory analytical detection limits or limits of quantitation (LCQ) are given in lab reports and are adequate for project objectives.	
14. Field records include: <ul style="list-style-type: none"><li>• Soil/sediment log sheets</li><li>• Water sampling log sheets</li><li>• QC field checklist</li><li>• Field instrument calibration logs</li><li>• Master bound logbook with sequentially numbered pages</li><li>• Daily logbook</li><li>• Chain-of-custody forms</li></ul>	
15. All applicable records described above were properly created and are on file.	
16. Samples passed laboratory data validation without any R flags (samples with J flags may be accepted at this level).	

Remarks: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Conclusion: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Data Classification Summary Checklist**  
**Class B Criteria**  
**Matrix: Ground Water**

To be classified for Class B use, the data must meet the following criteria:

Criteria	Evaluation Result
<b>A. Data Validation Result</b>	
1. Samples of this matrix have not been flagged J or R during data validation.	
2. All samples of this matrix have been classified as Level A data.	
<b>B. Quantitative Statistical Significance</b>	
1. Laboratory and field instruments were properly standardized (calibrated) employing proper methods and records are available.	
2. Sample bottle preparation was proper and appropriate for the parameters measured and the sample matrix.	
3. All laboratory procedures were referenced to approved EPA methods and were contained in an approved SOP manual.	
4. Analytical QC data was available to demonstrate proper instrument calibration.	
5. Laboratory QC check sample standards are EPA and NBS traceable and were used at least once each three months.	
6. Laboratory reagent (method) blanks were analyzed at frequency of at least 1 per 20 samples.	
7. Laboratory duplicates were analyzed at a frequency of at least 1 per 20 samples.	
8. Laboratory matrix spikes and matrix spike duplicates were analyzed at a frequency of at least 1 per 20 samples.	
9. Field replicates if required were analyzed at a frequency of at least 1 per 10 samples.	

**Class B Criteria (continued)**

<b>Criteria</b>	<b>Evaluation Result</b>
10. Field blanks were submitted at a frequency of at least 1 per 20 samples.	
11. One trip blank was submitted for VOCs analysis with each cooler.	
12. Field split samples if required were analyzed at a frequency of at least 1 per 20 samples per matrix.	
13. Appropriate and sufficient QC data with acceptance criteria were presented to allow data validation by the project QA officer.	
14. If required for the project, the laboratories used were approved by the EPA for participation in the CLP.	
15. The laboratories participated in round-robin testing program by WPA or other accrediting agency.	
16. QC limits were consistent with or exceed the limits established by the EPA for all methods of analysis or the EPA CLP.	
17. All samples submitted were analyzed for the requested parameters.	
<b>C. Custody and Document Control</b>	
1. Field custody of all samples was noted in a bound field logbook.	
2. Transfer of custody documentation (chain-of-custody form) signed by field and laboratory sample custodians is available and properly completed.	
3. Laboratory custody is documented by a designated lab sample custodian in a master log and a secured sample storage area.	
4. Sample identification and assigned laboratory tracking numbers are traceable through the entire monitoring system.	



**Class B Criteria (continued)**

Criteria	Evaluation Result
5. Field notebooks, log sheets, logbooks, checklists, reports, data validations, and custody documents are stored in a secure repository or under the control of a document custodian.	
6. All records, forms, logbooks, etc., are filled out completely in indelible ink without alterations except as initialed.	
7. All sample log sheets have been signed by the sample collector.	
8. Field logbook sheets signed by the field sample custodian.	
<b>D. Sample Representativeness</b>	
1. Compatibility exists between field and laboratory measurements or incompatibilities have been suitably explained.	
2. Laboratory analysis and/or sample preparation or extraction were within allowable holding times established for the sample preservation and methods used.	
3. Sample storage was maintained within suitable temperature, light and moisture conditions to guarantee sample integrity.	
4. Proper sample containers were used for the parameters analyzed.	
5. Proper sample collection equipment was used such that the equipment would neither contribute nor remove any substance to or from the sample.	
6. The sample site selection criteria are consistent with the objectives of the investigation and will provide the required data.	

**Remarks:** \_\_\_\_\_  
\_\_\_\_\_

**Conclusion:** \_\_\_\_\_  
\_\_\_\_\_

**Appendix B**  
**USATHAMA Methods**

**USATHAMA Method Number: UW14**  
**Determination of Explosives in Water**  
**By High-performance Liquid Chromatography**

**I. SUMMARY**

**A. Analytes**

This method is applicable to the Class 1 analysis of the following organic compounds in environmental water samples.

Analytes

1,3-Dinitrobenzene  
2,4-Dinitrotoluene  
2,6-Dinitrotoluene  
HMX (octahydro-1,3,5,7-tetranitro-s-tetrazocine)  
Nitrobenzene  
RDX (hexahydro-1,3,5-trinitro-s-triazine)  
Tetryl (N-methyl-N,2,4,6-tetranitrobenzenamine)  
1,3,5-Trinitrobenzene  
2,4,6-Trinitrotoluene

**B. Matrix**

This method is applicable to all environmental water matrices.

**C. General Method**

Detection Limit 5 ppb

**II. APPLICATION**

**A. Tested Concentration Range**

This certification testing ranges in micrograms per liter ( $\mu\text{g/L}$ ) are:

Analyte	Tested Range in ( $\mu\text{g/L}$ )		
1,3-Dinitrobenzene	1.501	-	40.1
2,4-Dinitrotoluene	0.503	-	40.2
2,6-Dinitrotoluene	0.655	-	52.4
HMS	0.361	-	28.9
Nitrobenzene	0.686	-	54.9
RDX	0.549	-	43.9
Tetryl	0.556	-	44.5
1,3,5,-Trinitrobenzene	0.526	-	42.1
2,4,6-Trinitrotoluene	0.502	-	40.2

**B. Sensitivity**

The instrumental responses for each compound, reported in peak area units at the certified reporting limit (CRL) are:

Analyte	Certified Reporting Limit (µg/L)	Area Counts
1,3-Dinitrobenzene	0.519	75000
2,4-Dinitrotoluene	0.612	80300
2,6-Dinitrotoluene	1.15	83200
HMS	1.65	43700
Nitrobenzene	1.07	104000
RDX	2.11	85100
Tetryl	0.556	36300
1,3,5-Trinitrobenzene	0.626	63100
2,4,6-Trinitrotoluene	0.588	58700

**C. Reporting Limits**

The certified reporting limits and upper certified limit for each analyte in environmental water samples are:

1,3-Dinitrobenzene	0.519	40.1
2,4-Dinitrotoluene	0.612	40.2
2,6-Dinitrotoluene	1.15	52.4
HMX	1.65	28.9
Nitrobenzene	1.07	54.9
RDX	2.11	43.9
Tetryl	0.556	44.5
1,3,5-Trinitrobenzene	0.626	42.1
2,4,6-Trinitrotoluene	0.588	40.2

**D. Interferences**

Any materials which are adsorbed from water on the cartridge, coelute with the explosives through the HPLC column, and which adsorb ultraviolet radiation at 250 nanometers (nm) may cause interferences.

The Porapak R material must be thoroughly cleaned to minimize interference. A late eluting component arising from the Porapak B required a 6-minute delay in sample injection following analysis of an extract. Carryover from analysis of a highly contaminated sample can result in apparent contamination of the succeeding samples analyzed. Such contamination is often manifest by the presence of unusually broad chromatographic peaks nested among narrower peaks. This interference is minimized by reanalyzing heavily contaminated samples following dilution, running blanks after heavily contaminated samples until carryover is removed, and/or rinsing the system with a mobile phase containing a high proportion of organic modifier until the contamination is removed.

**E. Analysis Rate**

After instrument calibration, one analyst can analyze approximately eight samples per 8-hour day.

**F. Safety Information**

The target compounds in this method are toxic explosives and some are known carcinogens, (e.g., 2,4-Dinitrotoluene). The preparation of all standards should be performed in a laboratory hood. Adequate dermal protection must be used when handling samples and standards.

Most of these compounds are either primary or secondary explosives and should be handled with care to avoid contact with electrostatic shocks or impacts. Tetryl and RDX have intermediate sensitivity between initiating explosives and explosives used as bursting charges. Tetryl is toxic when taken internally or by skin contact. RDX, HMS, and TNT are used as bursting charge explosives. Although TNT is less sensitive to friction and impact than many other high explosives, it can be detonated with moderate force when confined between metal surfaces such as on the threads of bolts. TNT will form sensitive materials in the presence of alkalis.

**III. APPARATUS AND CHEMICALS**

**A. Glassware/hardware**

1. Sorbent Cartridge — 6 ml Octyl Disposable Extraction Columns (J.T. Baker, Phillipsburg, NJ) were used. After removing the top plug and the packing material, 0.5 mg of cleaned Porapak R was added to each tube.
2. Baker 10 Solid Phase Extraction System, (J.T. Baker, Phillipsburg, NJ) including manifold, 75 ml reservoirs and adapters.
3. Class A Volumetric flasks — 10, 100 and 500 ml.
4. Class A Volumetric pipets — 0.5, 1.0, 2.0 ml.
5. Aspirator
6. Disposable micro pipets — 25, 50, 100 and 200  $\mu$ L.

**B. Instrumentation**

1. HPLC: Shimadzu Model LC-6A high-performance liquid chromatograph (or, equivalent).
2. Detector: Perkin-Elmer LC-75 variable wavelength ultraviolet absorbance detector (UV) set at 250 nanometers.
3. Column: Zorbax ODS (octadecylsilane), reverse-phase column, 25 centimeters (cm) length x 4.6 millimeters (mm) I.D., 5 micrometers ( $\mu$ m) particle size (Mac-Mod Analytical Inc., Chadds Ford, PA).
4. Altax 210A Injection Valve, (Beckman Instr. Inc., Berkley, CA).
5. Mobile phase: Isocratic, 25% methanol/17% acetonitrile/48% water.
6. Flow rate: 1.0 milliliters per minute (mL/min).
7. Sample Volume: 500 microliters ( $\mu$ L).

**C. Analytes**

Analyte	USATHAMA	
	Abbrev.	CAS Number
1,3-Dinitrobenzene	DNB	99-65-01
2,4-Dinitrotoluene	24DNT	121-14-2
2,6-Dinitrotoluene	26DNT	606-20-2
HMX	HMS	2691-41-0
Nitrobenzene	NB	98-95-3
RDX	RDX	121-84-4
Tetryl	TETRYL	479-45-8
1,3,5-Trinitrobenzene	TNB	25377-32-6
2,4,6-Trinitrotoluene	TNT	118-96-7

**D. Reagents and Sarms**

1. The standards used for target compound certification and calibration are USATHAMA supplied standard analytical reference materials (SARMS). Equivalent standards may be used as long as they have been characterized according to Section 6.5.3 of the USATHAMA Quality Assurance Plan (2nd Edition, March 1987). USATHAMA SARMS were used in this certification, and their lot numbers are listed below:

Analyte	Sarm Lot Number
1,3-Dinitrobenzene	2250
2,4-Dinitrotoluene	1147
2,6-Dinitrotoluene	1148
HMX	1217
Nitrobenzene	2177
RDX	1130
Tetryl	1149
1,3,5-Trinitrobenzene	1154
2,4,6-Trinitrotoluene	1129

2. Methanol (HPLC grade — American Burdick & Jackson, McGaw Park, IL).
3. Water (ASTM Type II/HPLC grade — American Burdick & Jackson, McGaw Park, IL).
4. Acetonitrile (HPLC grade — American Burdick & Jackson, McGaw Park, IL).
5. Acetone (HPLC grade — American Burdick & Jackson, McGaw Park, IL).
6. Porapak R, 80-100 Mesh — (Supleco, Inc., Bellefont, PA), cleaned by six acetone extractions, six acetonitrile extractions and six methanol extractions followed by air drying (75 cc of the resin was contacted with 200 mL of solvent for 10 minutes in a sonicator at each extraction step.)

## IV. CALIBRATION

### A. Initial Calibration

#### 1. Preparation of Standards.

Precertification Calibration. Separate primary stock standards (SPSS) for each target analyte are prepared according to the dilution scheme presented in Table C-1. The SPSS solutions should be prepared fresh every two months. Tetryl needs to be made fresh every two weeks. Each separate stock solution is made to volume with acetonitrile.

Aliquots of the SPSSs are used to prepare the combined stock standard (CSS) by dilution to final volume of 10 ml using acetonitrile as described in Table C-2. The CSS solution should be prepared fresh every day.

For precertification calibration, duplicate composite calibration standards (CCS-1 through CCS-7) are prepared from the CSS as given in Tables C-3 and C-4. HPLC-grade water is used for dilution to final volumes for the composite calibration standards. Standards are prepared fresh daily.

Initial Calibration. Standards CCS-1, CCS-3, CCS-5, CCS-6, CCS-7, and a blank described in Tables C-3 and C-4 are prepared. These solutions are prepared fresh for every run. Reference materials are not available for verification of the calibration curve, therefore staggering of spikes will be important.

2. Instrument Calibration. To calibrate the instrument, 500  $\mu$ L of each standard in Tables C-3 and C-4 is injected into the instrument in the same manner as a sample extract. Each duplicate composite calibration standard is analyzed during precertification calibration, and the single dilutions of the composite standards are analyzed during initial calibration.
3. Independent Reference Standard. An independent stock will be prepared to serve as a reference standard for explosives in water. The independent reference standard must be analyzed along with the initial and precertification calibration standards, and the results must be within  $\pm 25\%$  of the expected value, for the calibration to be considered valid. If the analysis of the independent reference standard fails, the source of the problem must be identified and corrected. The results of the second analysis of the independent reference standard must be within the acceptable limits before the analysis of samples may proceed. Since a new initial calibration is performed daily, a reference is required at least weekly.
4. Analysis of Calibration Data. After analyzing the standards (i.e., one blank and seven standards), the data are tabulated and graphed. For precertification calibration, the duplicate calibration data are analyzed using the lack of fit (LOF) and zero intercept (ZI) tests (USATHAMA QA Plan, 2nd Edition, March 1987).

## B. Daily Calibration

1. Preparation of Standards. The daily calibration standards are CCS-1, CCS-3, CCS-5, CCS-6, CCS-7, and a blank as presented in Tables C-3 and C-4. These standards must be prepared fresh daily. The daily calibration curve used by ESE for this method is actually the same as an initial calibration curve defined by the USATHAMA QA Plan, March 1987.
2. Instrument Calibration. At the beginning of each analytical run, inject 500  $\mu$ L of each standard presented in Section IV.B.1, above. At the end of the analytical run, the CCS-1 standard will be analyzed.
3. Analysis of Calibration Dyata. The response for the target compounds does not have to be less than 25 % different from the response obtained during the previous initial calibration, because each run is an initial calibration. Since reference solutions are not readily available, responses should be monitored to evaluate trends changes in stocks. It is advised that stocks for standards and spike solutions be staggered to monitor for degradation of the solutions.

The response of the target compounds in the end run standard (CSS-1) must be less than 25 % different from response factors obtained from the CSS-1 standard analyzed at the beginning of the day. If the response is greater than 25 % different, the standard will be reanalyzed. If reanalysis still fails the 25 % criterion, a new initial calibration must be performed and all analyses since the last acceptable calibration must be repeated. After seven calibrations have been completed, the end of run response must agree to within two times the standard deviation of the mean response rather than a percentage. Failure of the righter criteria will not be an automatic requirement for reanalyses if documentation exists to ensure that data quality of the samples is not affected by instrument drift (i.e., increase in sensitivity and all samples less than the CRL). In addition, drifts outside criteria and within 25 % should be evaluated in the light of expected method performance.

## V. CERTIFICATION TESTING

Spiked samples for certification testing are prepared in standard water (ASTM Type II grade water containing 100 mg/L of sulfate and chloride, see Section 4.5.1 of the USATHAMA QA Plan, March 1987 Edition) as outlined in Tables C-5 and C-6. A composite stock standard (CSS) (see Table C-2) is prepared yfor use as a spiking solution. Spiking is performed for certification testing on four separate days. Analysis of the spiked samples follows the procedure outline in Section VII.

The target versus found data are analyzed using the LOF and ZI tests (USATHAMA QA Plan, March 1987). The result of these tests and the certification data are presented in Section XI.D (see Attachment 3) for each target analyte.

## VI. SAMPLE HANDLING AND STORAGE

### A. Sampling Procedure

Sampling will be collected using adequate dermal and inhalation protection and must follow Sections 5.6 and 5.7 of the USATHAMA Quality Assurance Plan (March 1987).



**B. Containers**

One-Liter amber-colored glass jars with Teflon-lined lids are required.

**C. Storage Conditions**

Samples and extracts should be kept chilled to 4°C and in the dark.

**D. Holding Time Limits**

Samples must be extracted within seven days of sampling date, and the extract must be analyzed within 40 days of extraction date.

**E. Solution Verification**

Verification of the calibration standards is based on the analyses of daily QC spikes and analysis of independent reference standards (if available). Since stable reference solutions are not readily available, staggered preparation of stock solutions for control spikes and standards needs to be implemented to ensure acceptable solution verification. An unextracted control spike solution should be analyzed weekly as a reference to check extraction and storage affects. The recovery of this reference must be within 25% of the true value or  $\pm 2$  standard deviations for recent performance (last seven runs). If criteria cannot be met for the target compounds, new stock solutions might need to be prepared.

**VII. PROCEDURE**

**A. Extraction**

A 6 mL Baker Disposable Extraction Column is repacked with 0.5 grams of cleaned Porapak R. The column is rinsed with 15 mL of acetonitrile and 30 mL of water. 500 mL of the sample is measured and passed through the column at a rate of 10 mL/minute. The column is then slowly eluted with 3 mL of acetonitrile which is collected in a 10 mL volumetric flask. The extract is diluted to volume with ASTM Type II/HPLC water.

**B. Chemical Reactions**

This method does not involve any chemical reactions.

**C. Instrumental Analysis**

Instrumental analysis involved injection of 500 mL of the extract onto the analytical column described in Section III.B. The instrumental conditions are specified in Section III.B.3, and the integrated output of the UV detector is used in the calculations of Section VIII. A six-minute delay of injection is required following analysis of any extracts to allow a late eluting component (arising from the Porapak R) to elute.

### VIII. CALCULATIONS

A linear regression equation is calculated from calibration data by regressing the response versus the concentration for each compound. The concentration of a target compound in the sample extract is calculated by substituting the response into the calibration curve equation. The same injection volume is used for standards and sample extracts. The following formula is used to calculate the analytical concentration in the samples (SC).

$$SC (\mu\text{g/L}) = \frac{EC \times EV}{SV}$$

Where:

EC is the extract concentration determined from the calibration curve in  $\mu\text{g/L}$ .

EV is the extract volume (10 mL).

SV is the sample volume (500 mL).

Method blank correction may be necessary and can be in terms of instrument response or concentration of the blank.

### IX. DAILY QUALITY CONTROL

#### A. Control Samples

Daily quality control samples consist of a standard matrix method blank (ASTM Type I water), duplicate spikes at the upper concentrations of the certified range, and a single level spike at approximately twice the certified reporting limit. These quality control samples should be carried throughout the entire method at the same time samples are run. Primary Stock Standards (SPSS) at a concentration of 100 mg/L are weighed up using 0.010 gm of each analyte diluted to 10 mL of acetonitrile. The SPSS are diluted to obtain a daily control spiking solution (DCSS) as presented in Table C-7. Table C-8 shows how the daily control spikes are prepared. Control analytes for this method are RDX, NB, TNB, TNT, and 24DNT.

#### B. Control Charts

Control charts are prepared for all of the target analytes being analyzed for using the percent recovery data from both the duplicate high-level spikes and the low-level spikes calculated according to the following equation:

$$\% \text{ Recovery} = \frac{\text{Found Conc.}}{\text{Spiked Concentration}} \times 100\%$$

The found response is corrected for method blank response prior to calculation of the found concentration. Method blank correction may be in terms of instrument response or in terms of the concentration in the blank.

1. Average percent recovery (X) of the two high concentration spiked QC samples in each lot.
2. Difference (R) between the two high concentration spiked QC samples in each lot.
3. Three-point moving average (X) percent recovery control chart for the low level spike in each lot.
4. Three-point moving average difference (R) control chart for the high concentration spike.

For values that fall outside the control limits and data points that are deemed as outliers, the data will be evaluated and corrective action will be taken.

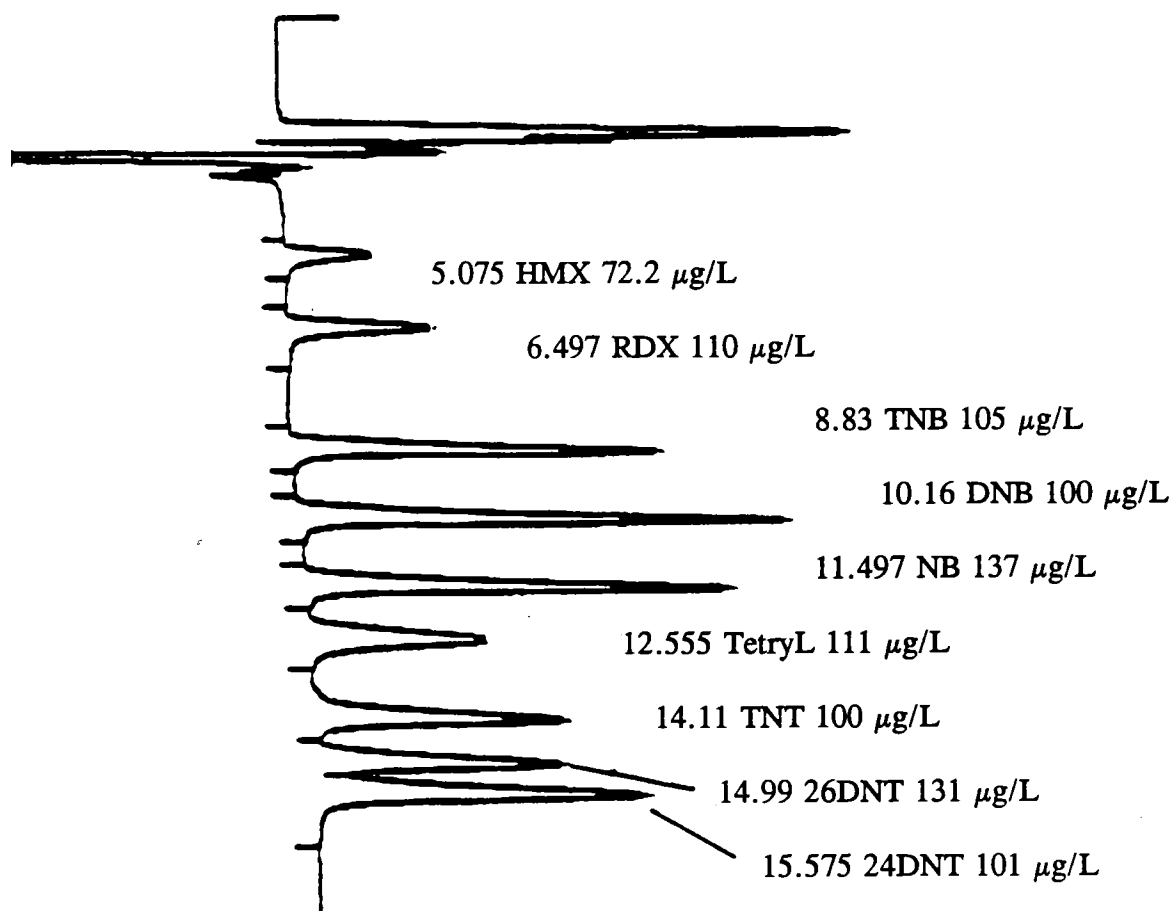
## **X. REFERENCES**

- A. U.S. Army Toxic and Hazardous Materials Agency, 1987, USATHAMA QA Program (December 1985, 2nd Ed., March 1987).

## **XI. DATA**

- A. **Off-the-shelf Analytical Reference Materials Characterization**  
Only SARMS were used in this certification.
- B. **Initial/precertification Calibration — see Attachment 1.**  
Response of each target analyte is tabulated at each calibration target concentration. The results from the LOF and ZI tests are presented.
- C. **Daily Calibration during Certification — see Attachment 2.**  
Calibration responses and required percentage on the end run standard.
- D. **Standard Certification Samples — see Attachment 3.**
- E. **Independent Reference Standards during Certification — see Attachment 4.**

# CHROMATOGRAM OF EXPLOSIVES IN WATER



**Table C-1**  
**Preparation of Separate Primary Stock Standards (SPSS)**

<b>Analyte</b>	<b>13DNB</b>	<b>24DNT</b>	<b>26DNT</b>	<b>HMX</b>	<b>NB</b>	<b>RDX</b>	<b>TETRYL</b>	<b>135TNB</b>	<b>246TNT</b>
mg SARM added	100.2	100.5	13.1	97.6	13.7	109.8	27.8	105.2	100.4
Final Volume (ml)	100.0	100.0	10.0	100.0	10.0	100.0	25.0	100.0	100.0
Concentration of SPSS ( $\mu\text{g/mL}$ )	1,002.0	1,005.0	1,310.0	976.0	1,370.0	1,098.0	1,112.0	1,052.0	1,004.0

**Note:**

Each SARM diluted to the volume indicated with acetonitrile.

**Source:**

ESE, 1988.

**Table C-2**  
**Preparation of Composite Stock Standard (CSS)**

Analyte	13DNB	24DNT	26DNT	HMX	NB	RDX	TETRYL	135TNB	246TNT
mg SARM added	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Final Volume (ml)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Concentration of SPSS ( $\mu\text{g/mL}$ )	10.02	10.05	13.1	9.76	13.7	10.98	11.12	10.52	10.04

**Note:**

Acetonitrile used for dilution to the 10 ml. final volume for the Composite Stock Standard (CSS).

**Source:**

ESE, 1988.

**Table C-3**  
**Preparation of Composite Calibration Standards 1 Through 4**  
**(CCS-1 through CCS-4)**

Analyte	13DNB	24DNT	26DNT	HMX	NB	RDX	TETRYL	135TNB	246TNT
Concentration in CCS-1 ( $\mu\text{g/L}$ )	2,000	2,010	2,610	1,950	2,740	2,200	2,220	2,100	2,010
Concentration in CCS-2 ( $\mu\text{g/L}$ )	1,000	1,010	1,310	976	1,370	1,100	1,110	1,050	1,000
Concentration in CCS-3 ( $\mu\text{g/L}$ )	501	503	655	488	686	549	556	526	502
Concentration in CCS-4 ( $\mu\text{g/L}$ )	200	201	262	195	274	220	222	210	201

**Notes:**

CCS-1 prepared by diluting 2.0 ml. of CSS to 10 ml. with ASTM Type II/HPLC-grade water.

CCS-2 prepared by diluting 1.0 ml. of CSS to 10 ml. with ASTM Type II/HPLC-grade water.

CCS-3 prepared by diluting 0.5 ml. of CSS to 10 ml. with ASTM Type II/HPLC-grade water.

CCS-4 prepared by diluting 0.2 ml. of CSS to 10 ml. with ASTM Type II/HPLC-grade water.

**Source:**

ESE, 1988.

**Table C-4**  
**Preparation of Composite Calibration Standards 1 Through 4**  
**(CCS-1 through CCS-4)**

Analyte	13DNB	24DNT	26DNT	HMX	NB	RDX	TETRYL	135TNB	246TNT
Concentration in CCS-5 ( $\mu\text{g/L}$ )	100	101	131	97.6	137	110	111	105	100
Concentration in CCS-6 ( $\mu\text{g/L}$ )	50.1	50.3	65.5	48.8	68.6	54.9	55.6	52.6	50.2
Concentration in CCS-7 ( $\mu\text{g/L}$ )	25.1	25.1	32.8	24.4	34.3	27.5	27.8	26.3	25.1

**Notes:**

CCS-5 prepared by diluting 0.1 ml. of CSS to 10 ml. with ASTM Type II/HPLC-grade water.

CCS-6 prepared by diluting 0.05 ml. of CSS to 10 ml. with ASTM Type II/HPLC-grade water.

CCS-7 prepared by diluting 0.025 ml. of CSS to 10 ml. with ASTM Type II/HPLC-grade water.

**Source:**

ESE, 1988.



**Table C-5**  
**Spiking Scheme for Certification Testing**  
**(0X through 2X)**

Analyte	HMX	RDX	TNB	DNB	NB	TetryL	TNT	26DNT	24DNT
Concentration in 0X ( $\mu\text{g/L}$ ) Level	0	0	0	0	0	0	0	0	0
Concentration in 0.5X ( $\mu\text{g/L}$ ) Level	0.361	0.549	0.526	0.501	0.686	0.556	0.502	0.655	0.503
Concentration in 1X ( $\mu\text{g/L}$ ) Level	0.722	1.10	1.05	1.00	1.37	1.11	1.00	1.31	1.01
Concentration in 2X ( $\mu\text{g/L}$ ) Level	1.44	2.20	2.10	2.00	2.74	2.22	2.01	2.62	2.01

**Notes:**

0X Level was 500 ml. of unspiked standard water.

0.5X Level prepared by spiking 25  $\mu\text{l.}$  of CSS into 500 ml. of standard water.

1X Level prepared by spiking 50  $\mu\text{l.}$  of CSS into 500 ml. of standard water.

2X Level prepared by spiking 100  $\mu\text{l.}$  of CSS into 500 ml. of standard water.

**Source:**

ESE, 1988.

**Table C-6**  
**Spiking Scheme for Certification Testing**  
**(5X through 40K levels)**

Analyte	HMX	RDX	TNB	DNB	NB	TetryL	TNT	26DNT	24DNT
Concentration in 5X ( $\mu\text{g/L}$ ) Level	3.61	5.49	5.26	5.01	6.86	5.56	5.02	6.55	5.03
Concentration in 10X ( $\mu\text{g/L}$ ) Level	7.04	11.0	10.5	10.0	13.7	11.1	10.0	13.1	10.1
Concentration in 20X ( $\mu\text{g/L}$ ) Level	14.4	22.0	21.0	20.0	27.4	22.2	20.1	26.2	20.1
Concentration in 40X ( $\mu\text{g/L}$ ) Level	28.9	43.9	42.1	40.1	54.9	44.5	40.2	52.4	40.2

**Notes:**

5X Level prepared by spiking 250  $\mu\text{l}$  of CSS into 500 ml of standard water.  
10X Level prepared by spiking 0.50 ml of CSS into 500 ml of standard water.  
20X Level prepared by spiking 1.0 ml of CSS into 500 ml of standard water.  
40X Level prepared by spiking 2.0 ml of CSS into 500 ml of standard water.

**Source:**

ESE, 1988.

**Table C-7**  
**Preparation of Daily Control Spiking Solution**  
**(DCSS)**

Analyte	13DNB	24DNT	26DNT	HMX	NB	RDX	TETRYL	135TNB	246TNT
ml SPSS added	0.1	0.1	0.1	0.2	0.1	0.2	0.05	0.1	0.1
Final Volume (ml)	10	10	10	10	10	10	10	10	10
Concentration of CSS ( $\mu\text{g/ml}$ )	10.0	10.0	10.0	20.0	10.0	20.0	10.0	10.0	10.0

**Note:**

Acetonitrile used for dilution to the 10 ml final volume for the DCSS.

**Source:**

ESE, 1988.

**Table C-8**  
**Daily Control Spiking Scheme**

	<b>Spiking Volume of DCSS (ml)</b>	<b>Final Volume (ml)</b>	<b>13DNB</b>	<b>24DNT</b>	<b>26DNT</b>	<b>HMX</b>	<b>NB</b>	<b>RDX</b>	<b>TetryL</b>	<b>135TNB</b>	<b>246TNT</b>
Low Level Spike	0.1	500	2.00	2.00	2.00	4.00	2.00	4.00	2.00	2.00	2.00
High Level Spike	1.0	500	20.0	20.0	20.0	40.0	20.0	40.0	20.0	20.0	20.0

***Note:***

Standard Water (See Section V) used for dilution to the 500 ml final volume for the spikes.

***Source:***

ESE, 1988.